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FINAL REPORT

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An Investigation on the Feasibility of the Use of Dry Floor System for Low Cost Construction

By:

Dr. Redzuan Abdullah
Faculty of Civil Engineering
Universiti Teknologi Malaysia
Skudai, Johor

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1.0 Introduction

Construction and property industry is a very important component of Malaysian economy. It spawns 126 sub-industries and contributing about 24% of the country's Gross Domestic Product (GDP). Malaysian housing industry mass-produces more houses on per capita basis than any other country in the world. Despite highly dynamic and important economic sector, building construction in Malaysia is still at the bottom rung of the building technology ladder [1].

Most of the Malaysian construction practices for low rise buildings such residential and shop lots today still use conventional methods such as reinforced concrete and brick works. The conventional methods are inefficient, dull, dirty, dangerous, low quality, noisy, disruptive and environmentally unfriendly. It is also labor intensive. As a consequence, huge numbers of foreign labors are lured into the country. The influx of too many foreign labors may cause rising social problems. Economically, labor cost is not forever cheap. Time will come when the labor cost and land speculation will combine to price the average Malaysian families out of house and property ownership [1].

Industrialized Building System (IBS) is being promoted by the Construction Industry Development Board (CIDB) of Malaysia as an alternative to the conventional construction method (CIDB, 2003) [2]. The IBS approach to construction is very efficient and non-labor intensive. As such, implementation of IBS not only competitive, but also can reduce the dependency on foreign labors. Other benefits of IBS include minimal wastage, efficient, tidier and safer worksites, better quality control, faster project completion, and lower total construction costs [1].

Structurally there are five IBS main groups identified as being used in this country [2]. These are:

1. Precast concrete framing, panels and box systems
2. Steel formworks systems
3. Steel framing systems
4. Prefabricated timber framing systems
5. Block work systems

A combination of steel and timber without use wet concrete or known dry construction, is one of possible light-weight structural components that can be developed further as an IBS system. Beside light-weight, the system is very simple and requires no skill labor to construct. Hence it is cost saving which is suitable for low cost construction. Among feasible aspects of application of this system in low cost building constructions are as load bearing wall and floor slab systems.

This report presents results of laboratory experiments and finite element analysis of steel-plywood composite dry slab system. The experiments were conducted at the structural laboratory of the Faculty of Civil Engineering, UTM. The project was funded under the fundamental research grant administered by the Ministry of higher Education, Malaysia.

1.1 Objective

The aim of this research project was to investigate the feasibility of the use of a composite dry board slab system made of plywood and cold-formed steel

deck. In order to achieve this aim, several objectives were identified as follows:

1. To evaluate the strength, deflection and interaction behavior of the slab system by laboratory testing.
2. To determine the effect of the steel deck thickness, plywood thickness and shape of the deck profile on the strength and behavior of the slab system.
3. To conduct numerical study to determine the response of the slab in various span lengths.

1.2 Scope

Due to limited financial resources, the testing of specimen was limited to three different thicknesses of plywood and steel deck, two types of deck profile and a single length of slab specimens. The effect of different span length was investigated by means of finite element analysis.

1.3 Importance of research

Because of the absence of concrete and the use of thin steel deck and plywood panel, the proposed dry slab system is extremely lightweight and flexible. Its construction is simple, fast and without needs of using sophisticated machinery and equipment. Because of that, the slab can be constructed by non-skill workers. Type of buildings that are feasible for the dry spab system are:

1) Timber buildings or simple dwelling units such as *kampung* houses, chalets, resorts and recreational buildings.
2) Temporary disaster relief shelters or temporary relocation houses where this system provides a fast, flexible and simple construction method without involving messy concreting work on site.
3) Temporary working platform supported by scaffolds during construction stage replacing timber runner-plywood in conventional construction trend.
4) Renovation work that requires safer, neater and quiet working environment.

2.0 Methodology

In this study, structural performance of composite slab using plywood and cold formed steel deck was evaluated by laboratory test and finite element analysis. In the laboratory test, the study involved determination of maximum load carrying capacity and deflection for serviceability measure of the slab. Effects of steel deck thickness, plywood thickness, type of steel deck profile and length of span were investigated. Due to limited financial resources, testing of slabs with variable span lengths was unable to be conducted. As such, the behavior of variable length slabs was studied using finite element method.

2.1 Description of test specimen

The specimens for the dry slab system were made by combining profiled steel decks and plywood panels using self-drilling screws as shown in Fig. 1. Two

types of deck profiles were used, namely SDP-51 and PEVA-45. SDP deck is manufactured by Steelon Roofing[6], while PEVA is manufactured by Asia Roofing[4]. PEVA-45 profile is similar to PEVA-45 manufactured by Swedish Profile[5]. The cross section for the SDP profile is shown in Fig. 2 and the PEVA profile is in Fig. 3. The section properties for both decks are given in Table 1. The plywood was of normal grade obtained from a local hardware shop and the screws were of flat head self-drilling type with 3 mm thread diameter and 38 mm length. The screws were placed at 100 mm on centers.

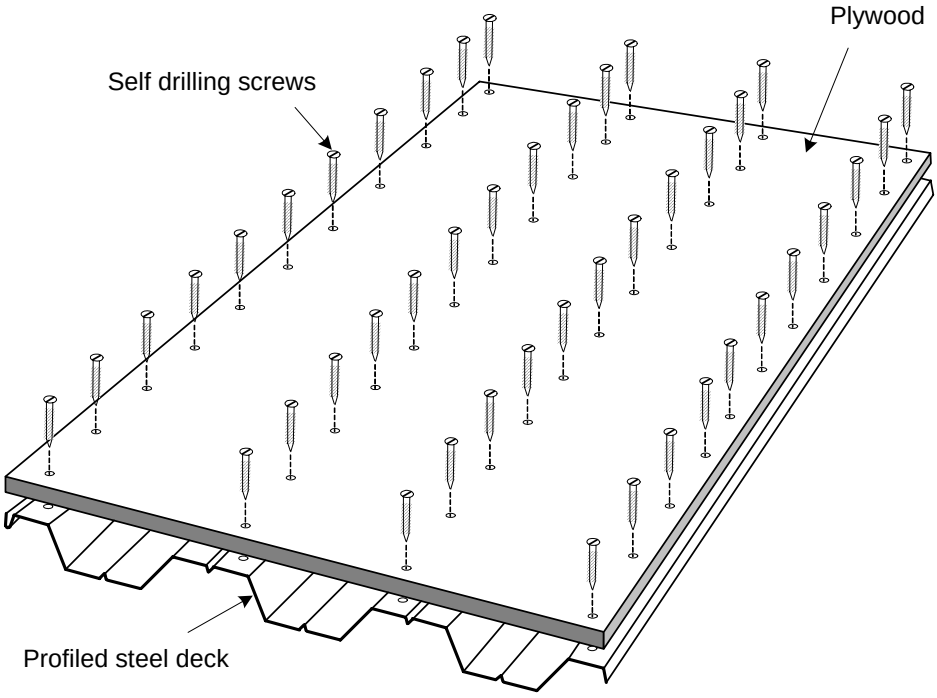

Fig. 1 Dry floor system using plywood and profile steel deck

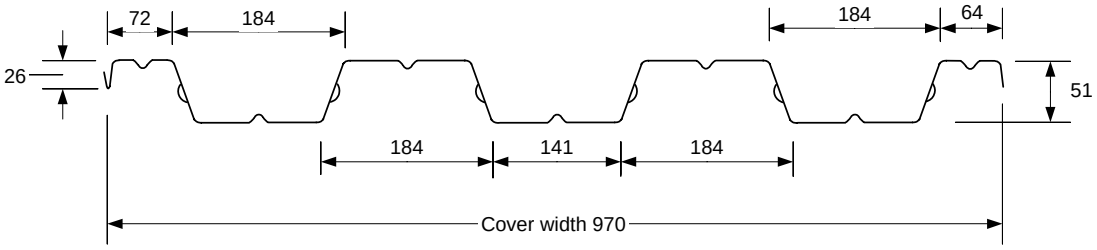

Fig. 2 Cross section of the SDP-51 deck [6]

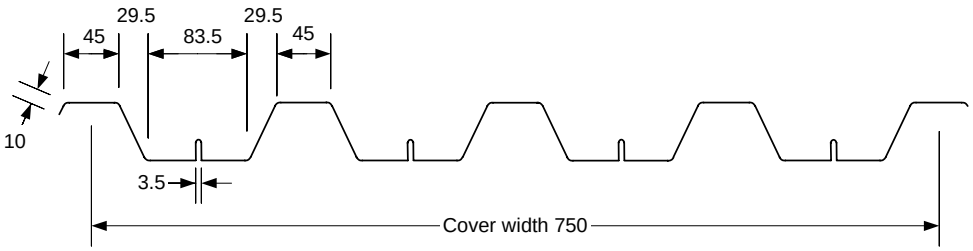

Fig. 3 Cross section of the PEVA-45 deck [5]

Table 1 Section properties of profiled decks [5, 6]

Deck Type	Base steel thickness (mm)	Weight of covered area (kg/m^2)	Effective 2nd moment of area, I (mm^4/m width)
SDP-51	0.8	8.59	332196
	1.0	10.56	448229
	1.2	12.54	570672
PEVA-45	1.0	13.33	349200

Twenty four specimens were built and tested in this test program. For each test parameter, two specimens were built. Hence twelve different parameters were investigated. The description of the test specimens are tabulated in Table 2. The specimens were named in the form of "*DECK-i*-PLY-*j*" where "*DECK*" is the variable representing the name of the steel deck profile, either SDP or PEVA. "*i*" represents the steel sheet thickness, and "*j*" represents the plywood

thickness. Hence, "SDP-0.8-PLY-9.5" refers to the specimen using SDP type steel deck with 0.8 mm steel sheet thickness, and 9.5 mm plywood thickness. The width of the specimen followed the dimension of one piece of the profiled deck while the length of the specimen is fixed at 2400 mm. Before testing, the specimens were weighed on weighing scale to determine the self weight of the slab system.

Table 2 Details of specimens

Specimen ID	Steel sheeting thickness, (mm)	Plywood thickness, (mm)	Width* x Length, (mm)	Measured total weight (kN)
SDP-0.8-PLY-9.5	0.8	9.5	980 x 2400	0.990
SDP-0.8-PLY-12.7	0.8	12.7	980 x 2400	1.432
SDP-0.8-PLY-18	0.8	18.0	980 x 2400	1.484
SDP-1.0-PLY-9.5	1.0	9.5	980 x 2400	1.030
SDP-1.0-PLY-12.7	1.0	12.7	980 x 2400	1.118
SDP-1.0-PLY-18	1.0	18.0	980 x 2400	1.569
SDP-1.2-PLY-9.5	1.2	9.5	980 x 2400	1.069
SDP-1.2-PLY-12.7	1.2	12.7	980 x 2400	1.530
SDP-1.2-PLY-18	1.2	18.0	980 x 2400	1.562
PEVA-1.0-PLY-9.5	1.0	9.5	790 x 2440	1.288
PEVA-1.0-PLY-12.7	1.0	12.7	790 x 2440	1.366
PEVA-1.0-PLY-18	1.0	18.0	790 x 2440	1.445

* The width of the deck is measured by the plywood dimension

2.2 Preparation of specimen

All specimens were prepared in a similar manner. The plywood was cut to obtain desired width and length using power hand saw. The plywood was then attached to the top flange of the steel deck using self-drilling screws. The screws were driven at 100 mm on centers by electric powered screw drivers.

2.3 Test Procedure

Bending tests on the specimens were conducted as shown in Fig. 4. The test diagram is shown in Fig. 5.

Before applying the load, the slab specimen, loading beam and spreader beam were weighed to obtain the self weight of the system. The loading and spreader beam weight were considered applied load hence the value was added to the load cell reading.

The loads were applied using a hydraulic jack against a reaction frame. A loading beam was used to transfer the load onto spreader beams which were placed at 600 mm from both ends. The spreader beams were stiff enough so that the loads were spread uniformly across the specimen width in the form of line loads. The loads were measured using a 25 kN capacity load cell. Vertical deflections were measured using LVDT which were placed at mid-span, and underneath the line loads. LVDT were also used to measure relative slippage between the plywood and the steel deck.

The loads were applied incrementally by hand pumped hydraulic jack, first by load control and followed by displacement control when the loads were closed to ultimate loads. Each load increment was held for at least 2 minutes to ensure that the slab was stabilized before the reading was recorded. Failure modes were also observed during the tests.

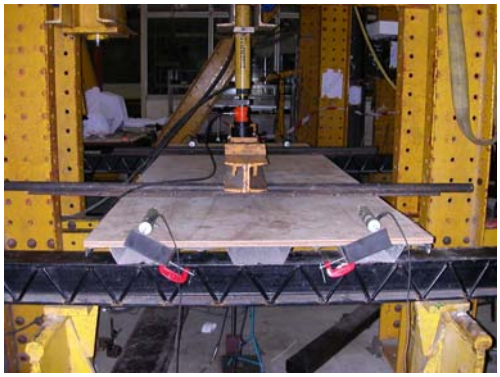

Fig. 4 Test setup

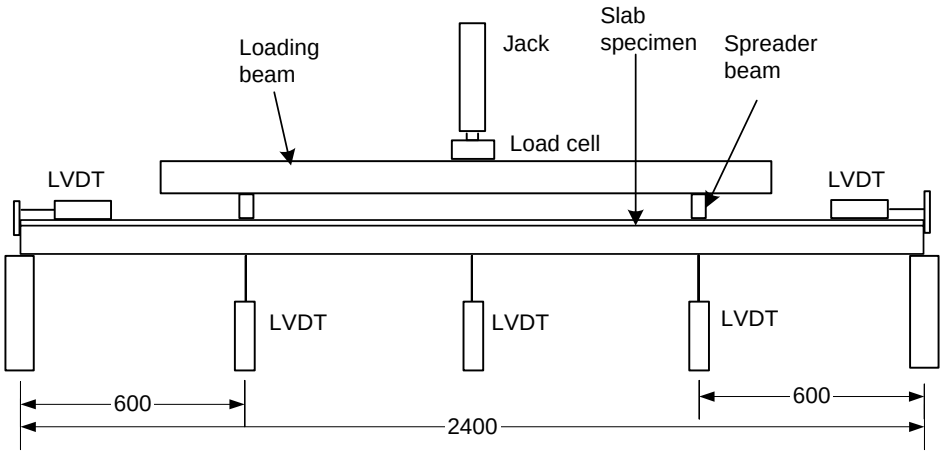

Fig. 5 Bending test diagram

2.4 Finite element modeling and analysis

The behavior of slabs whose lengths are longer than the length of test specimens was determined using Finite Element Method. LUSAS Modeller, version 13.6 [7] was used in the study. Three-dimensional model with non linear material was considered in the analysis.

Preliminary models similar to specimen SDP-08-PLY-18 and SDP-10-PLY-12.7 were developed to determine the appropriate element type, geometries and

suitable attributes for material properties. Fig. 6 shows typical mesh for the slab model. Both plywood and the steel sheet were represented by 8-node quadrilateral semiloof shell element (QSL8).

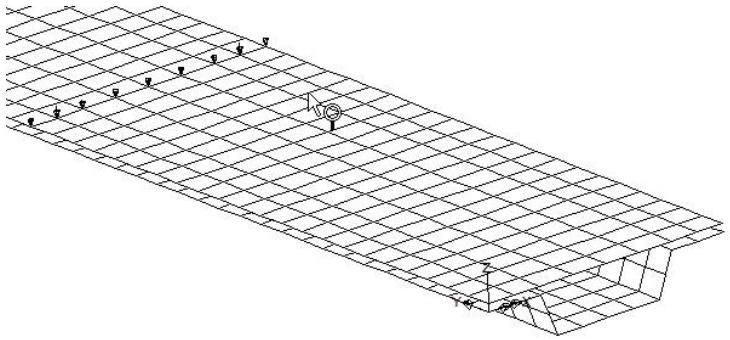

Fig. 6 Finite element model

In the development of the finite element model, a few assumptions were made as listed blow:

1) Full interaction between the plywood and the profiled steel deck were assumed where no slip or separation has occurred between the two components. In the model, this interaction was achieved by Tied Mesh function. Because of this assumption, screws were not presented in the model.
2) Both plywood and steel deck were assumed as isotropic materials.
3) Only non linear material was considered. The plywood non linear material property was assumed based on published literature [3]. The steel property was assumed as elastic-perfectly plastic.
4) Because the thickness of the steel sheet is very small compared to its other two dimensions, the compression elements (i.e. top flanges) were assumed to buckle locally before the yield stress was achieved. Local

buckling in the top flange of steel deck was observed in the experiment when the load reached close to the ultimate value. The material model was simplified to simulate local buckling behaviour by reducing the effective yield stress. The yield stress value for the top flange was set after several trial and errors.

5) Due to the presence of embossments, the material behaviour of the deck web was also assumed to have a reduced value. Both modulus of elasticity and yield strength of the webs were reduced. Trial and error process was also used to determine the appropriate values.

6) The yield strength of the bottom flange was assumed slightly lower than the value available in the manufacturer's catalogue.

7) The modulus of elasticity of the bottom and top flanges was assumed typical of steel value.

Fig. 7 shows the comparison of graphs of load versus deflection between the test data and the finite element results. Based on these results, the finite element model and the corresponding attributes for material properties were used as a basis to analyze variable span models.

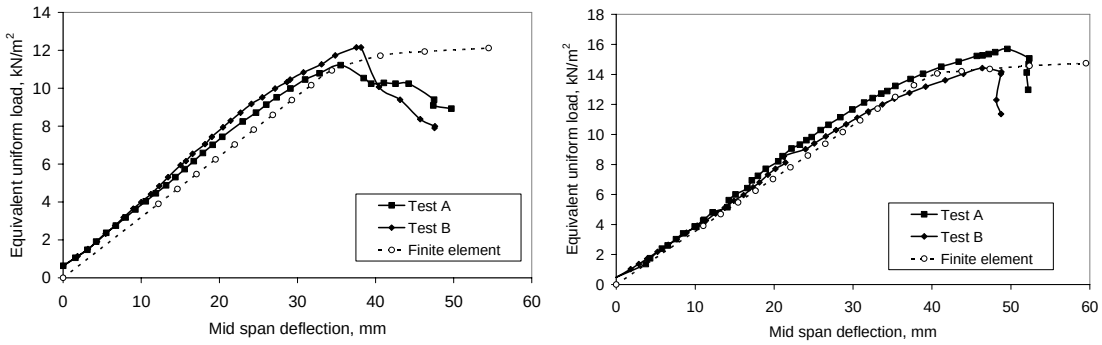

Fig. 7 Comparison between test and finite element results, (a) SDP-08-PLY-18 and (b) SDP-10-PLY-12.7

3.0 Results and analysis

Test results will be presented and discussed in the following sub-topics according to the topic of interest.

3.1 Failure behavior

From observation, the specimen began to fail when a loud 'popping' sound was heard and followed by the decreasing of load reading on the data logger. The sound was attributed to local buckling of top flange below one of the line load. Failure occurred underneath one of the line loads. The failure was indicated by a permanent bend of plywood as well as local buckling (crippling) of the deck top flanges and webs along the width of the slab (Fig. 8 and Fig. 9). However, at failure, the slab system could sustain quite a large vertical deflection without disintegration of plywood or steel deck.

A sign of tension in the screws near the failure line was observed where the screw heads near the line load sank less slightly (typically less than 0.5 mm) into the plywood. However there was no sign of separation or end slip between the plywood and the steel deck. Even though there were readings of LVDTs that were used to measure the differential movement between plywood and steel deck in horizontal direction, their values were negligibly small. Often these LVDTs recorded a reading when the load was closed to the ultimate. This observation indicated that the screws at 100 mm apart were sufficient to hold the plywood and the steel deck together to act as a composite system.

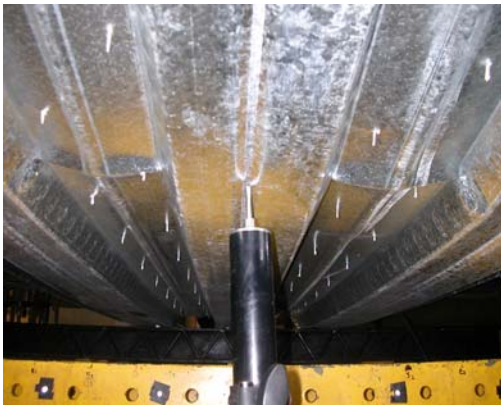

Fig. 8 Crippling of deck top flange and web

Fig. 9 Permanent bend of plywood and steel deck

3.2 Test data

Test data obtained from LVDTs and load cell readings (plus loading beams) are given in Appendix I.

3.3 Equivalent uniform load versus mid span deflection

For the purpose of sensible comparison between the applied load (in kN) and design load (in kN/m^2), the applied loads were converted to equivalent uniform load. The conversion was done by equating the maximum moment of a uniformly distributed load beam to the maximum moment of a two-point load of a simply supported beam similar to the test;

$$\frac{wl^2}{8} = \frac{PL_s}{2}$$
$$w = PL_s\left(\frac{4}{l^2}\right)$$

where P = load cell reading plus loading and spreader beam weight, L_s = Shear span length, w = equivalent uniform load, and l = span length between supports. The calculation was for a meter width of the slab, hence w is in kN/m^2.

The graphs of the equivalent uniform loads versus mid-span deflections for all specimens are shown in Appendix II.

3.4 Maximum loads, corresponding deflections and deflection limit.

The maximum loads and the corresponding deflections are given in Table 3. The values show that all deflections at maximum loads are larger than the maximum permissible deflection of l/180 (BS 5950: Part 4: 1994), where for 2400 mm span length, the deflection limit is only 13.33 mm. This is a clear indication that the slab system is quite flexible and is not possible for service up ultimate load.

Table 3 Maximum loads and deflections

Specimen	Test number	Max. load (kN/m^2)	Deflection at max load (mm)
SDP-0.8-PLY-9.5	Test A	10.89	39.40
	Test B	10.92	41.52
SDP-0.8-PLY-12.7	Test A	12.47	40.04
	Test B	11.57	39.14
SDP-0.8-PLY-18	Test A	11.21	35.52
	Test B	12.14	38.13
SDP-1.0-PLY-9.5	Test A	14.25	41.24
	Test B	15.36	43.57
SDP-1.0-PLY-12.7	Test A	15.69	49.56
	Test B	14.42	46.38
SDP-1.0-PLY-18	Test A	17.28	48.07
	Test B	18.69	53.16
SDP-1.2-PLY-9.5	Test A	20.26	49.42
	Test B	18.39	44.35
SDP-1.2-PLY-12.7	Test A	21.86	49.90
	Test B	21.33	50.06
SDP-1.2-PLY-18	Test A	22.38	54.69
	Test B	21.93	47.00
PEVA-1.0-PLY-9.5	Test A	9.54	40.93
	Test B	10.12	40.75
PEVA-1.0-PLY-12.7	Test A	10.06	36.24
	Test B	12.69	47.54
PEVA-1.0-PLY-18	Test A	14.95	49.45
	Test B	13.68	53.57

3.5 Effect of plywood thickness

As shown in Table 4, as the thickness of plywood increased from 9.5 mm to 18 mm, the maximum loads of the slabs made of SDP decks increased from 7% to 24% while the slabs made of PEVA decks increased by 46%. The graphs of equivalent uniform load versus mid span deflection for slabs made of SDP decks comparing the effect of different plywood thickness are shown in Fig. 10(a) through (d).

Table 4 Comparison of maximum loads due to different plywood thicknesses

		Maximum load (kN/m²)			Average increase of max. load (%)
		Plywood thickness 9.5 mm	Plywood thickness 12.7 mm	Plywood thickness 18 mm	
SDP-0.8	Test A	10.89	12.47	11.21	7%
	Test B	10.92	11.57	12.14	
SDP-1.0	Test A	14.25	15.69	17.28	24%
	Test B	15.36	14.42	18.69	
SDP-1.2	Test A	20.26	21.86	22.38	15%
	Test B	18.39	21.33	21.93	
PEVA-1.0	Test A	9.54	10.06	14.95	46%
	Test B	10.12	12.69	13.68	

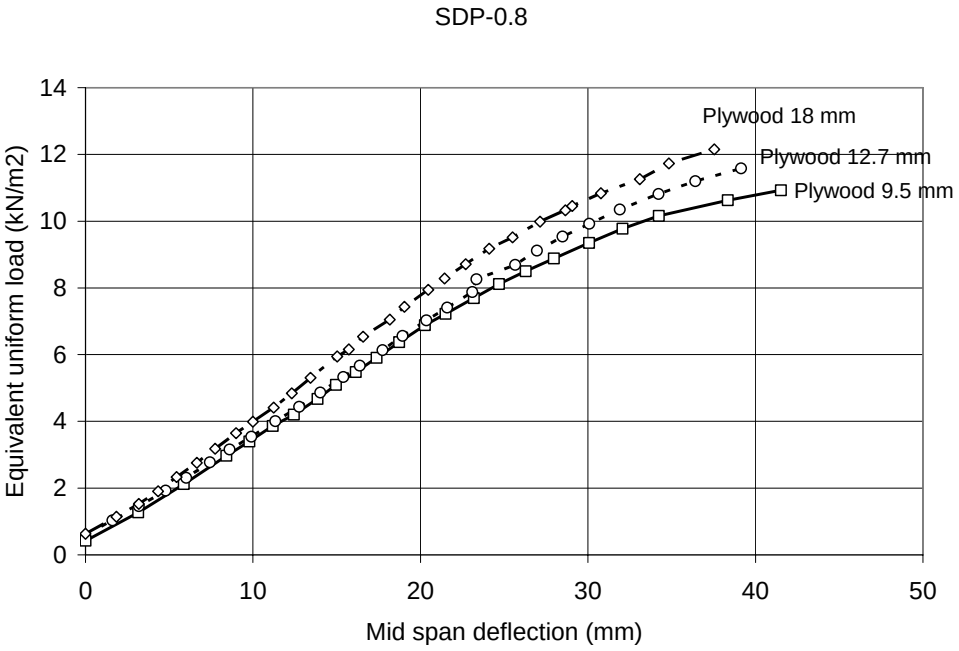

Fig. 10(a) Equivalent uniform load versus mid span deflection for slabs made of SDP-0.8 decks.

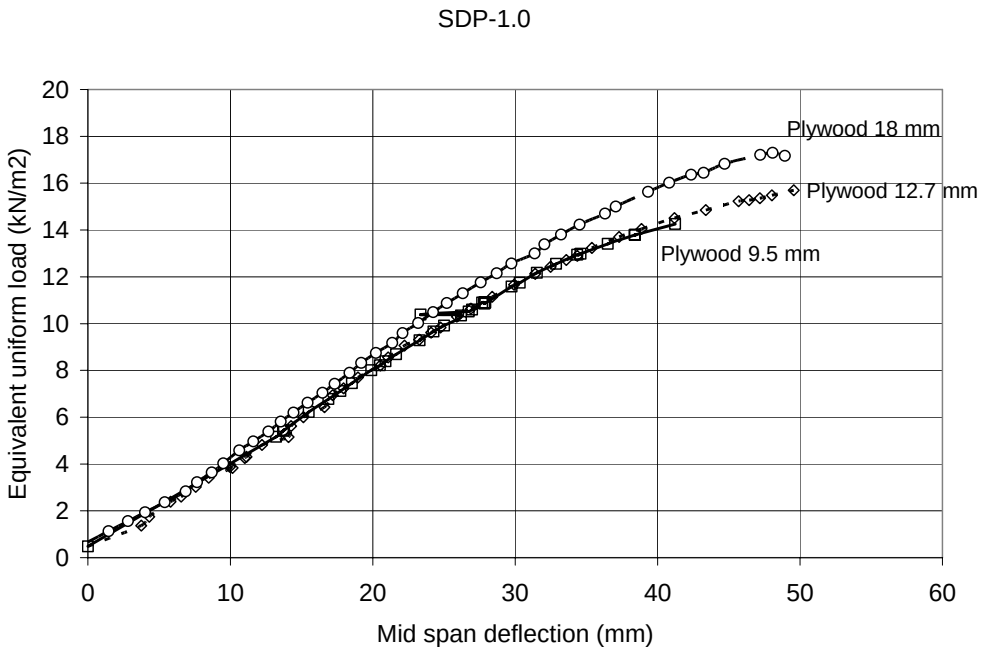

Fig. 10(b) Equivalent uniform load versus mid span deflection for slabs made of SDP-0.8 decks.

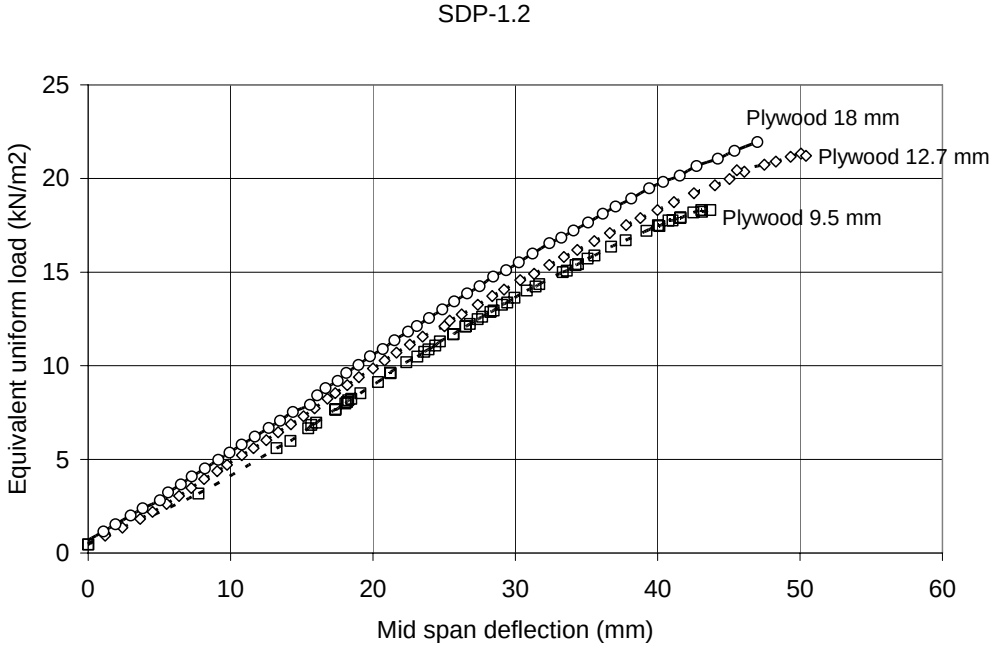

Fig. 10(c) Equivalent uniform load versus mid span deflection for slabs made of SDP-0.8 decks.

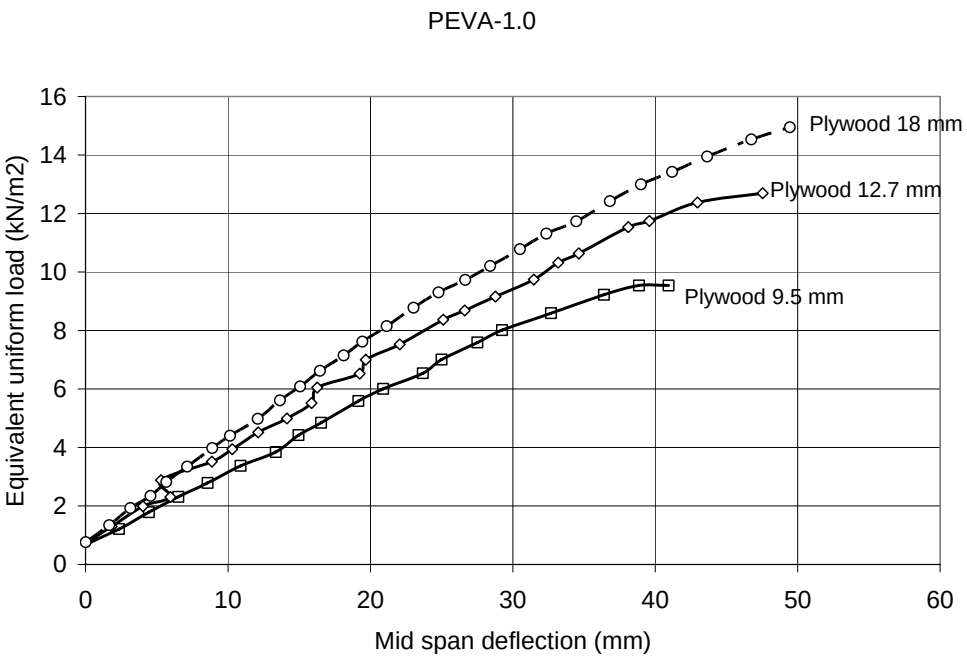

Fig. 10(d) Equivalent uniform load versus mid span deflection for slabs made of PEVA-1.0 decks.

3.6 Effect of Steel Sheet Thickness

Table **5** shows the maximum loads due to different steel sheet thicknesses. As the thickness of the steel sheets increased from 0.8 mm to 1.2 mm, the maximum loads of the slabs made SDP deck increased from 77% to 90%. The graphs of equivalent uniform load versus mid span deflection for slabs made of SDP deck comparing the effect of steel sheet thicknesses are shown in Fig. 10(a), (b) and (c).

Table 5 Comparison of maximum loads due to different steel thicknesses

		Maximum load (kN/m²)			Average increase of max. load (%)
		Steel thickness 0.8 mm	Steel thickness 1.0 mm	Steel thickness 1.2 mm	
PLY-9.5	Test A	10.89	14.25	20.26	77%
	Test B	10.92	15.36	18.39	
PLY-12.7	Test A	12.47	15.69	21.86	80%
	Test B	11.57	14.42	21.33	
PLY- 18	Test A	11.21	17.28	22.38	90%
	Test B	12.14	18.69	21.93	

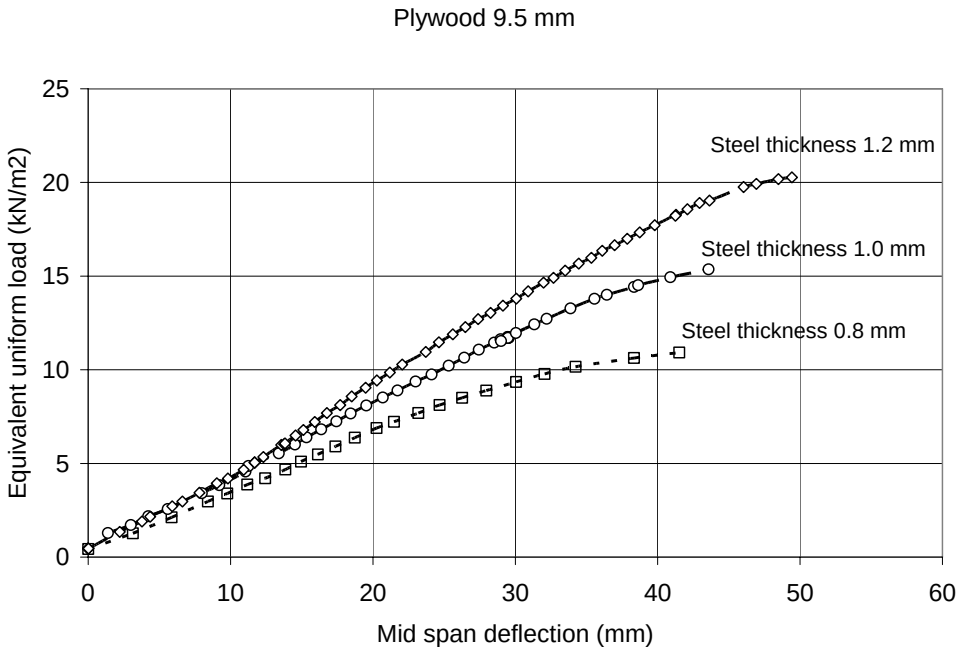

Fig. 11(a) Equivalent uniform load versus mid span deflection for slabs made of different steel deck thickness using 9.5 mm plywood.

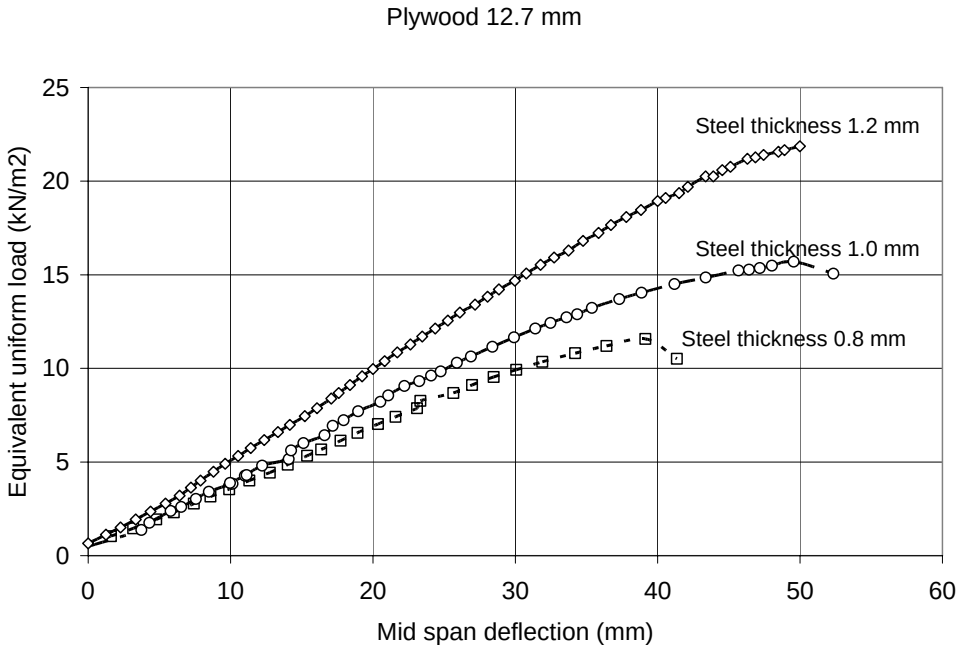

Fig. 11(b) Equivalent uniform load versus mid span deflection for slabs made of different steel deck thickness using 12.7 mm plywood.

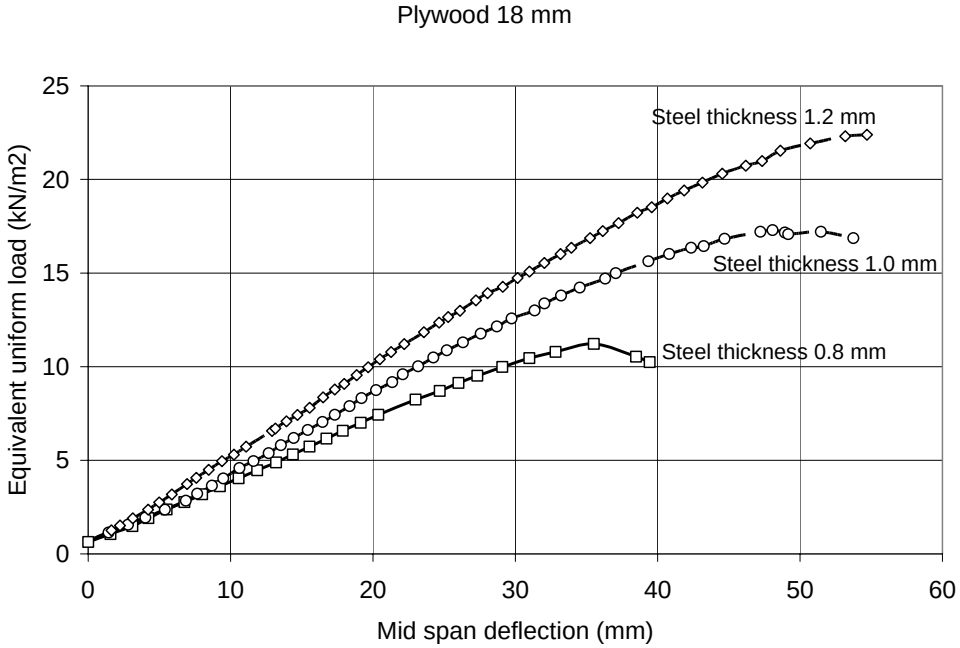

Fig. 11(c) Equivalent uniform load versus mid span deflection for slabs made of different steel deck thickness using 18 mm plywood.

3.7 Effect of profile shape

Two types of deck were used to build the slabs specimens, namely SDP-1.0 and PEVA-1.0 to study the effect of different deck profiles. The section properties shown in Table 1 indicate that the profile shape of the deck affects the bending stiffness (i.e. modulus of elasticity) of the deck. PEVA deck utilizes more material but having lesser 2nd moment of area than the SDP deck. In order to compare the strength of slabs made of these two decks, the maximum loads from the tests were normalized with the moment of inertia and the amount of steel used to build the deck (i.e. the deck weight per covered area) as given in Table 1. The results are shown in Table **6**. The values of normalized loads show that the slab made of SDP are stronger than those made of PEVA deck, both for ultimate loads and for the load at L/180 deflection limit.

Table 6 Comparison of normalized maximum loads between slabs made of SDP and PEVA decks

		Weight of steel, w_s (kg/m²)	Moment of Inertia, I (mm⁴/m)	Ult. load, w_u (kN/m²)	$\frac{w_u}{(w_s)(I)}$	Load at deflection limit of L/180, w_l	$\frac{w_l}{(w_s)(I)}$
SDP-1.0-PLY-9.5	Test A	10.56	448229	14.25	3.01	5.2	1.10
	Test B			15.36	3.25	5.5	1.16
SDP-1.0-PLY-12.7	Test A			15.69	3.31	5.0	1.06
	Test B			14.42	3.05	5.0	1.06
SDP-1.0-PLY-18	Test A			17.28	3.65	5.7	1.20
	Test B			18.69	3.95	5.7	1.20
Average					3.37		1.13
PEVA-1.0-PLY-9.5	Test A	13.33	349200	9.54	2.05	3.9	0.84
	Test B			10.12	2.17	4.0	0.86
PEVA-1.0-PLY-12.7	Test A			10.06	2.16	4.4	0.95
	Test B			12.69	2.73	4.8	1.03
PEVA-1.0-PLY-18	Test A			14.95	3.21	5.5	1.18
	Test B			13.68	2.94	4.6	0.99
Average					2.54		0.97

3.8 Ultimate and maximum service loads versus unfactored design loads (service load)

Ultimate loads and maximum service loads (i.e. loads at *l*/180 and at *l*/360 deflection limits) were compared with service loads (i.e. unfactored design loads) as shown in Table 7. The service load composes of dead loads due to self weight of the specimens and imposed load or live load. The self weights of the specimens were measured by weighing scale while the imposed load value was 1.5 kN/m^2, which is the imposed load for a residential building as specified by BS 6399: Part 1: 1966. The values of $\frac{w_u}{w_s}$ (i.e safety factor) show that, the ultimate loads that can be taken by the slabs are ranging from 4.42 to 20.34 higher than the service loads. When the serviceability is concerned, the value of $\frac{w_{l/180}}{w_s}$ (i.e. safety factors for the maximum service loads at *l*/180) show that the safety factor for the deflection limit are ranging from 1.81 to 3.17 . For a more stringent deflection limits, i.e. *l*/360, the values of safety factors are in the range of 1.06 to 1.58.

Table 7 Safety factors for ultimate loads and maximum service loads as compared to the service loads (i.e. unfactored design loads)

Specimen ID		Service load, w_s (kN/m²)	Ultimate load from test, w_u	$\frac{w_u}{w_s}$	Maximum service load at l/180 defln. Limit, $w_{l/180}$ (kN/m²)	$\frac{w_{l/180}}{w_s}$	Maximum service load at l/360 defln. Limit, $w_{l/360}$ (kN/m²)	$\frac{w_{l/360}}{w_s}$
SDP-0.8-PLY-9.5	Test A	1.92	10.89	5.67	4.6	2.40	2.5	1.30
	Test B	1.92	10.92	5.69	4.5	2.34	2.3	1.20
SDP-0.8-PLY-12.7	Test A	1.98	12.47	6.30	5.2	2.63	2.5	1.26
	Test B	1.98	11.57	5.84	4.6	2.32	2.4	1.21
SDP-0.8-PLY-18	Test A	2.13	11.21	5.26	4.9	2.30	2.8	1.31
	Test B	2.13	12.14	5.70	5.3	2.49	2.8	1.31
SDP-1.0-PLY-9.5	Test A	1.94	14.25	7.35	5.2	2.68	3.0	1.55
	Test B	1.94	15.36	7.92	5.5	2.84	3.0	1.55
SDP-1.0-PLY-12.7	Test A	2.11	15.69	7.44	5.0	2.37	2.6	1.23
	Test B	2.11	14.42	6.83	5.0	2.37	2.6	1.23
SDP-1.0-PLY-18	Test A	2.17	17.28	7.96	5.7	2.63	2.8	1.29
	Test B	2.17	18.69	8.61	5.7	2.63	2.8	1.29
SDP-1.2-PLY-9.5	Test A	1.96	20.26	10.34	5.9	3.01	3.0	1.53
	Test B	1.96	18.39	9.38	5.6	2.86	3.0	1.53
SDP-1.2-PLY-12.7	Test A	2.15	21.86	10.17	6.6	3.07	3.2	1.49
	Test B	2.15	21.33	9.92	6.5	3.02	3.0	1.40
SDP-1.2-PLY-18	Test A	2.21	22.38	10.13	6.8	3.08	3.5	1.58
	Test B	2.21	21.93	9.92	7.0	3.17	3.7	1.67
PEVA-1.0-PLY-9.5	Test A	2.16	9.54	4.42	3.9	1.81	2.3	1.06
	Test B	2.16	10.12	4.69	4.0	1.85	2.3	1.06
PEVA-1.0-PLY-12.7	Test A	2.21	10.06	4.55	4.4	1.99	2.5	1.13
	Test B	2.21	12.69	5.74	4.8	2.17	3.1	1.40
PEVA-1.0-PLY-18	Test A	2.25	14.95	6.64	5.5	2.44	3.0	1.33
	Test B	2.25	13.68	6.08	4.6	2.04	2.7	1.20
			mean	7.19		2.52		1.34
			Standard deviation	1.96		0.39		0.17

3.9 Maximum length of slab

Because of financial limitation, test on variable length specimen was unable to be conducted. As an alternative, finite element analyses were performed to determine the response of the slabs whose span lengths were larger than the test specimens. Slab models using SDP deck whose thicknesses are 0.8mm, 1.0mm and 1.2mm and plywood whose thicknesses are 9.5mm, 12.7mm and 18mm were analyzed for span lengths 3m, 3.6m and 4.2m. The modeling method followed the discussion given in Section 2.4.

The analysis results for all models had shown that the maximum loads occurred when the mid points deflections exceeded the *l*/180 and *l*/360 deflection limits. As such, only loads at *l*/180 and *l*/360 deflection limits obtained from the finite element analysis were deemed as significant for design purpose, and hence they are presented herein (shown in Table 8 and Table 9). These loads were considered as allowable loads. A comparison between the service loads and the allowable loads are presented in Table 8 and Table 9 respectively. As can be seen from the shaded cells of Table 8, the maximum length allowed for slabs SDP-0.8-PLY-9.5, SDP-0.8-PLY-12.7, SDP-0.8-PLY-18, SDP-1.0-PLY-9.5, and SDP-1.0-PLY-12.7 is 3m. This is to ensure that the deflection due to service load will not exceed the deflection limit of *l*/180 as indicated by the $\frac{w_s}{w_{l/180}}$ being less than unity. For stiffer slabs, which are SDP-0.8-PLY-9.5, SDP-0.8-PLY-9.5, SDP-0.8-PLY-9.5 and SDP-0.8-PLY-9.5, the maximum length allowed is 3.6 m.

If a more stringent deflection limit is imposed, i.e. *l*/360 non of the slabs could be used for spans equal to 3 m and larger. This is indicated by all values of $\frac{w_s}{w_{l/180}}$ being larger than unity.

Table 8 Comparison between service load and allowable loads at *l*/180 deflection limit

Slab model	Service load w_s (kN/m²)	3 m span		3.6 m span		4.2 m span	
		Allowable load at *l*/180 defln. Limit, $w_{l/180}$ (kN/m²)	$\frac{w_s}{w_{l/180}}$	Allowable load at *l*/180 defln. Limit, $w_{l/180}$ (kN/m²)	$\frac{w_s}{w_{l/180}}$	Allowable load at *l*/180 defln. Limit, $w_{l/180}$ (kN/m²)	$\frac{w_s}{w_{l/180}}$
SDP-0.8-PLY-9.5	1.92	1.92	1.00	1.61	1.19	1.36	1.41
SDP-0.8-PLY-12.7	1.98	2.02	0.98	1.70	1.16	1.46	1.36
SDP-0.8-PLY-18	2.13	2.20	0.97	1.89	1.13	1.58	1.35
SDP-1.0-PLY-9.5	1.94	2.30	0.84	1.93	1.01	1.65	1.18
SDP-1.0-PLY-12.7	2.11	2.44	0.86	2.04	1.03	1.75	1.21
SDP-1.0-PLY-18	2.17	2.63	0.83	2.20	0.99	1.90	1.14
SDP-1.2-PLY-9.5	1.96	2.68	0.73	2.25	0.87	1.92	1.02
SDP-1.2-PLY-12.7	2.15	2.83	0.76	2.37	0.91	2.03	1.06
SDP-1.2-PLY-18	2.21	3.04	0.73	2.55	0.87	2.19	1.01

Table 9 Comparison between service load and allowable loads at *l*/360 deflection limit

Slab model	Service load w_s (kN/m²)	3 m span		3.6 m span		4.2 m span	
		Allowable load at *l*/360 defln. Limit, $w_{l/360}$ (kN/m²)	$\frac{w_s}{w_{l/360}}$	Allowable load at *l*/360 defln. Limit, $w_{l/360}$ (kN/m²)	$\frac{w_s}{w_{l/360}}$	Allowable load at *l*/360 defln. Limit, $w_{l/360}$ (kN/m²)	$\frac{w_s}{w_{l/360}}$
SDP-0.8-PLY-9.5	1.92	0.96	2.00	0.81	2.37	0.69	2.78
SDP-0.8-PLY-12.7	1.98	1.02	1.94	0.85	2.33	0.73	2.71
SDP-0.8-PLY-18	2.13	1.10	1.94	0.93	2.29	0.79	2.70
SDP-1.0-PLY-9.5	1.94	1.15	1.69	0.96	2.02	0.87	2.23
SDP-1.0-PLY-12.7	2.11	1.22	1.73	1.02	2.07	0.88	2.40
SDP-1.0-PLY-18	2.17	1.32	1.64	1.10	1.97	0.95	2.28
SDP-1.2-PLY-9.5	1.96	1.35	1.45	1.12	1.75	0.97	2.02
SDP-1.2-PLY-12.7	2.15	1.41	1.52	1.18	1.82	1.02	2.11
SDP-1.2-PLY-18	2.21	1.52	1.45	1.28	1.73	1.09	2.03

4.0 Summary and Conclusion

4.1 Summary

Simple, fast construction and lightweight structural component has become a subject of interest in building construction nowadays. A composite slab using plywood and cold formed steel deck is a type of dry slab that fall under these categories. In this study, structural performance of composite slab using plywood and cold formed steel deck was evaluated by laboratory experiments and finite element analyses. Mainly the study involved determination of maximum load carrying capacity and deflections for serviceability measures of the slabs. Effect of steel deck thickness, plywood thickness, type of steel deck profile and length of span were investigated. Due to limited financial resources, testing of slabs with variable span lengths was unable to be conducted. The behavior of variable length slabs was studied using finite element method.

4.2 Conclusion

The following is a list of findings derived from the study:

1) The behavior of the dry floor slab depended on the plywood and steel deck thickness, deck profile shape, and the interaction between the plywood and the steel deck. In this study, the connection between the plywood and the steel deck was achieved by using self drilling screws. However the screw was not a parameter of the study. From the

observation of the test, it can be concluded that the 3 mm diameter screws fastened at 100 mm apart along deck top flanges was sufficient to achieve a complete interaction between the plywood and the steel deck. The failure of the slabs at ultimate loads was always governed by the buckling of steel deck top flanges.

2) The stiffness and load carrying capacities of the slabs increased with the thickness of the plywood and the thickness of the steel deck. The steel deck thickness had increased the slab stiffness and strength faster than the plywood thickness.

3) When measured in terms of the amount of material used and the bending stiffness due to the shape of deck profiles, slabs made of SDP decks were stronger than that made of PEVA decks.

4) The ultimate loads were achieved at deflections very much higher than the allowable deflections. This indicates that the slab design should be governed by the serviceability (i.e. deflection) limit. The slabs made of 0.8 mm and 1.0 mm thick SDP decks met the serviceability limit for residential buildings only when their span lengths were 3000 mm or less while the slabs made of 1.2 mm thick SDP decks can be put on service up to 3600 mm long.

5) Even though the slabs were governed by the serviceability limit, in average the ultimate loads were 7 times greater than the service load. This provides a satisfactory safety factor in case overloading.

6) Typical range of span length for residential buildings is 3 – 4.8 m. Some of the slab configurations in this study met less than half of this span

requirement but with very minimal safety factor. In order to use the slab in longer spans, as well as to guarantee the comfortable level of safety factor, thicker plywood, thicker steel deck and deeper profile should be considered. This however subjected to further investigation especially by means of laboratory test.

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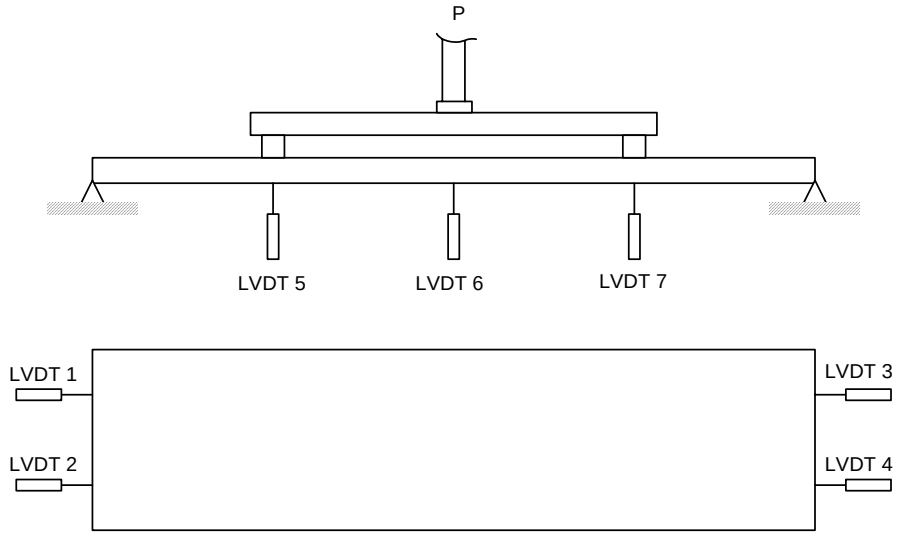
APPENDIX I – Test data

Test data listed in this Appendix are the reading of the load cell and LVDTs. The LVDT numbers are as shown in the following diagrams:



Locations of LVDT

Note: The total loads presented in the tables below include the spreader and loading beams weight

Specimen: SDP-0.8-PLY-9.5 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
0.99	-0.01	-0.01	0	0	0	0.72	0
3.29	-0.07	0	-0.06	-0.04	2.76	3.61	2.59
4.19	-0.09	0.03	-0.06	-0.07	3.63	4.84	3.49
5.09	-0.12	0.03	-0.09	-0.12	4.37	5.87	4.23
5.99	-0.14	0.03	-0.14	-0.15	5.17	6.97	5.02
6.99	-0.14	0.04	-0.2	-0.17	6.06	8.21	5.88
7.99	-0.15	0.07	-0.26	-0.17	7	9.47	6.75
8.99	-0.17	0.1	-0.29	-0.15	7.98	10.82	7.68
9.99	-0.18	0.14	-0.31	-0.14	8.52	12.23	8.64
10.99	-0.2	0.15	-0.36	-0.14	9.51	13.55	9.57
11.99	-0.23	0.18	-0.36	-0.06	10.37	14.76	10.39
13.09	-0.23	0.23	-0.39	-0.06	11.2	15.96	11.26
13.89	-0.23	0.28	-0.37	-0.01	11.9	17.01	11.98
14.99	-0.28	0.31	-0.37	0.01	12.76	18.53	12.91
16.09	-0.34	0.32	-0.4	0.06	13.78	19.92	13.99
16.99	-0.32	0.39	-0.39	0.1	14.65	20.99	14.91
17.99	-0.34	0.42	-0.39	0.17	15.46	22.86	16
18.99	-0.31	0.48	-0.37	0.25	16.48	22.99	17.06
19.99	-0.32	0.56	-0.39	0.32	17.67	26.01	18.31
20.99	-0.29	0.62	-0.37	0.4	18.94	27.75	19.64
21.99	-0.23	0.73	-0.31	0.53	20.21	30.02	21
22.89	-0.18	0.8	-0.28	0.61	21.39	31.5	22.27
23.29	-0.17	0.84	-0.23	0.67	22.02	32.44	22.93
23.29	-0.18	0.87	-0.23	0.72	22.24	32.51	23.19
23.69	-0.18	0.91	-0.21	0.75	22.64	33.4	23.61
23.89	-0.18	0.92	-0.2	0.76	23.01	34.08	24.01
24.19	-0.17	0.97	-0.15	0.84	23.56	34.91	24.6
24.49	-0.17	1	-0.1	0.89	24.05	35.6	25.15
24.69	-0.18	1.05	-0.06	0.94	24.53	35.09	25.67
24.89	-0.17	1.09	0.01	1	25.04	37.12	26.23
25.09	-0.18	1.13	0.04	1.05	25.53	37.9	26.79
25.59	-0.17	1.22	0.1	1.17	26.49	39.4	27.9
20.29	-0.25	1.22	1.06	2.11	24.47	39.36	32.31
20.09	-0.26	1.2	1.14	2.13	24.4	39.34	32.43
20.09	-0.26	1.2	1.28	2.22	24.93	41.73	33.89
18.99	-0.23	1.17	1.83	2.26	24.8	41.57	35.97
17.79	-0.17	1.14	2.08	2.26	24.4	41.6	36.67
17.49	-0.15	1.14	2.13	2.26	24.28	41.6	36.86

Specimen: SDP-0.8-PLY-9.5 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
0.99	0	0.01	-0.01	0	0.01	0.01	0.02
2.99	-0.04	0	-0.06	-0.01	2.55	3.15	2.3
4.99	-0.07	0	-0.02	-0.02	4.68	5.87	4.31
6.99	-0.06	0.06	-0.31	-0.43	6.64	8.41	6.13
7.99	-0.07	0.12	-0.36	-0.51	7.71	9.78	7.13
9.09	-0.07	0.17	-0.39	-0.54	8.79	11.18	8.11
9.89	-0.06	0.21	-0.39	-0.58	9.76	12.44	9.01
10.99	-0.06	0.29	-0.37	-0.59	10.85	13.85	10.01
11.99	-0.07	0.28	-0.39	-0.61	11.69	14.96	10.85
12.89	-0.09	0.25	-0.37	-0.61	12.55	16.14	11.72
13.89	-0.15	0.21	-0.32	-0.61	13.46	17.38	12.63
14.99	-0.21	0.2	-0.31	-0.61	14.47	18.73	13.63
16.19	-0.29	0.2	-0.28	-0.59	15.56	20.27	14.7
16.99	-0.36	0.21	-0.23	-0.54	16.46	21.49	15.57
18.09	-0.43	0.26	-0.18	-0.47	17.71	23.19	16.82
19.09	-0.5	0.28	-0.09	-0.4	18.81	24.69	17.88
19.99	-0.58	0.31	-0.01	-0.36	19.95	26.28	19
20.89	-0.65	0.37	0.07	-0.28	21.16	27.96	20.17
21.99	-0.67	0.47	0.2	-0.21	22.67	30.06	21.62
22.99	-0.76	0.56	0.32	-0.12	24.08	32.06	23.02
23.89	-0.84	0.69	0.45	-0.03	25.65	34.23	24.54
24.99	-1.08	0.89	0.64	0.17	28.57	38.35	27.34
25.69	-1.22	1.08	0.78	0.29	30.9	41.52	29.48
19.69	-0.37	2.08	0.75	0.28	38.57	42.37	26.78
16.59	-0.26	2.27	0.7	0.26	40.11	42.7	26.27
16.59	-0.26	2.24	0.7	0.26	40.2	42.7	26.22
16.49	-0.25	2.29	0.69	0.28	40.68	43.02	26.3
16.39	-0.25	2.32	0.67	0.28	40.7	43	26.26
16.19	-0.25	2.33	0.67	0.28	40.78	42.92	26.15

Specimen: SDP-0.8-PLY-12.7 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.432	0.01	0.03	0.01	0.01	0.01	0	0.01
2.532	-0.06	0.04	0.04	0.01	1.25	1.62	1.46
3.632	-0.06	0.04	0.04	0.01	2.56	3.26	2.83
4.532	-0.03	0.03	0.03	0	3.53	4.46	3.82
6.632	0.04	0.04	0.06	-0.03	5.56	7.08	5.86
7.632	0.06	0.07	0.07	-0.03	6.39	8.17	6.67
8.632	0.07	0.1	0.09	-0.01	7.29	9.35	7.54
9.432	0.06	0.14	0.09	-0.01	8.06	10.37	8.27
10.532	0.1	0.2	0.09	-0.01	9.03	11.66	8.63
11.432	0.18	0.23	0.1	-0.04	9.94	12.21	9.48
12.632	0.21	0.26	0.14	-0.07	11.11	13.77	10.57

13.632	0.25	0.29	0.15	-0.07	11.95	14.91	11.38
14.432	0.26	0.29	0.17	-0.1	12.61	15.77	11.96
15.632	0.31	0.29	0.25	-0.07	13.63	17.13	12.91
16.432	0.31	0.31	0.25	-0.07	14.26	17.99	13.5
17.632	0.36	0.37	0.31	-0.06	15.29	19.4	14.5
18.432	0.39	0.4	0.34	-0.07	16.15	20.59	15.33
19.332	0.47	0.42	0.39	-0.06	16.96	21.76	16.16
20.432	0.56	0.47	0.45	0.01	17.95	23.14	17.12
21.432	0.7	0.51	0.51	0.04	18.97	24.61	18.17
22.432	0.89	0.56	0.58	0.1	20.12	26.22	19.3
23.532	1.03	0.65	0.62	0.15	21.24	27.8	20.39
24.532	1.24	0.73	0.7	0.23	22.46	29.52	21.58
25.432	1.44	0.84	0.78	0.31	23.65	31.2	22.74
26.632	1.67	0.95	0.89	0.4	25.19	33.34	24.23
27.432	1.85	1.05	0.98	0.48	26.49	35.16	25.5
28.532	2.18	1.24	1.16	0.65	28.43	37.83	27.34
29.332	2.4	1.39	1.3	0.75	30.03	40.04	28.88
24.932	4.12	2.02	1.46	0.72	36.44	43.45	30.27
24.832	4.17	2.05	1.49	0.7	36.49	43.43	30.24
25.332	4.25	2.21	1.49	0.72	38.23	45.04	31.05
24.532	4.66	2.35	1.49	0.72	40.91	46.82	31.53

Specimen: SDP-0.8-PLY-12.7 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.432	-0.01	0	-0.01	0	-0.01	-0.01	0
2.432	-0.01	0	0.01	0	1.28	1.61	1.24
3.432	-0.03	0.01	0.01	0	2.53	3.18	2.48
4.532	-0.01	-0.03	0.06	0.01	3.81	4.79	3.69
5.432	-0.03	-0.04	0.14	0.01	4.77	6.02	4.56
6.532	-0.03	-0.06	0.2	0.01	5.83	7.43	5.57
7.432	-0.04	-0.04	0.26	0.01	6.74	8.6	6.4
8.332	-0.06	-0.04	0.36	0.06	7.74	9.91	7.29
9.432	-0.06	-0.04	0.42	0.1	8.82	11.33	8.28
10.432	-0.09	-0.04	0.45	0.15	9.89	12.76	9.32
11.432	-0.07	-0.04	0.48	0.18	10.8	14.02	10.22
12.532	-0.09	-0.01	0.5	0.23	11.78	15.39	11.22
13.332	-0.07	-0.15	0.53	0.25	12.49	16.38	11.93
14.432	-0.06	-0.17	0.54	0.29	13.46	17.73	12.9
15.432	-0.06	-0.2	0.58	0.36	14.31	18.93	13.76
16.532	-0.04	-0.2	0.62	0.42	15.33	20.36	14.79
17.432	-0.01	-0.2	0.67	0.47	16.19	21.59	15.66
18.532	0.01	-0.18	0.75	0.54	17.24	23.1	16.73
19.432	0.01	-0.17	0.8	0.59	18.1	23.34	17.64
20.432	0.04	-0.15	0.91	0.64	19.01	25.65	18.57
21.432	0.06	-0.12	0.92	0.72	19.93	26.96	19.51
22.432	0.1	-0.1	1.03	0.8	20.99	28.48	20.59
23.332	0.17	-0.09	1.14	0.87	22.08	30.07	21.7
24.332	0.21	-0.07	1.25	1	23.35	31.9	23.01
25.432	0.31	-0.06	1.52	1.19	24.93	34.21	24.67

26.332	0.36	-0.09	1.69	1.33	26.45	36.41	26.22
27.232	0.47	-0.06	1.96	1.58	28.3	39.14	28.19
24.732	0.59	-0.15	2.65	2.41	28.89	41.35	32.25
24.232	0.62	-0.17	2.73	2.46	28.73	41.27	32.46
24.432	0.61	-0.18	2.84	2.48	28.91	41.62	32.87
24.532	0.62	-0.18	2.99	2.52	29.15	42.17	33.61
23.932	0.61	-0.17	3.32	2.63	29.21	42.74	34.82
23.532	0.59	-0.18	3.57	2.81	29.54	43.84	36.49
23.032	0.59	-0.17	3.83	2.95	30.11	45.68	39.31

Specimen: SDP-0.8-PLY-18 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.484	0.01	0	0	0.01	0.01	0.01	0.01
2.484	-0.04	0.01	0	0.01	1.37	1.57	1.11
3.484	-0.06	0.04	0.01	0.01	2.61	3.11	2.21
4.484	-0.06	0.06	0.01	0.04	3.54	4.24	3.04
5.584	-0.06	0.09	0.01	0.04	4.56	5.52	3.96
6.484	-0.06	0.14	0	0.06	5.57	6.76	4.85
7.484	-0.04	0.17	0.01	0.09	6.56	8.01	5.72
8.484	-0.03	0.17	0.01	0.09	7.55	9.26	6.6
9.484	-0.03	0.17	0.01	0.15	8.59	10.58	7.54
10.484	-0.01	0.17	0	0.18	9.59	11.87	8.44
11.484	0	0.18	-0.01	0.25	10.59	13.2	9.36
12.484	0.01	0.2	-0.01	0.31	11.45	14.38	10.22
13.484	-0.01	0.21	-0.03	0.37	12.3	15.55	11.06
14.484	-0.01	0.21	-0.06	0.43	13.17	16.74	11.91
15.484	-0.01	0.21	-0.07	0.47	14	17.89	12.72
16.484	-0.04	0.21	-0.07	0.54	14.94	19.15	13.58
17.484	-0.06	0.23	-0.07	0.59	15.86	20.38	14.42
19.384	-0.06	0.29	-0.06	0.8	17.8	22.99	16.22
20.484	-0.06	0.36	-0.01	0.95	19.06	24.7	17.38
21.484	-0.07	0.4	0.04	1.02	20.03	26.01	18.29
22.384	-0.06	0.47	0.01	1.14	21.01	27.34	19.2
23.484	-0.06	0.53	0.17	1.28	22.3	29.1	20.41
24.584	-0.04	0.62	0.25	1.44	23.69	30.99	21.69
25.384	-0.03	0.72	0.36	1.63	25.05	32.83	22.94
26.384	-0.03	0.87	0.51	1.89	27.02	35.52	24.72
24.784	-0.06	1.61	0.59	2.07	30.89	38.49	25.89
24.084	-0.04	2	0.59	2.07	32.88	39.44	25.88
24.184	-0.03	2.26	0.59	2.07	34.74	41.05	26.54
24.084	0.03	2.4	0.58	2.07	36.47	42.55	27.14
24.084	0.14	2.54	0.58	2.08	38.38	44.24	27.86
22.084	0.61	2.92	0.56	2.05	43.49	47.49	28.59
21.384	0.7	2.99	0.58	2.07	43.71	47.39	28.35
20.984	0.95	3.34	0.61	2.02	47.24	49.7	28.95

Specimen: SDP-0.8-PLY-18 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.484	0.01	0.01	0.03	0.01	0	0	-0.01
2.684	-0.03	0.03	0.06	0.03	1.51	1.85	1.29
3.584	-0.03	0.01	0.06	0.04	2.66	3.18	2.21
4.484	-0.04	0	0.06	0.04	3.6	4.33	3.04
5.484	-0.03	-0.03	0.06	0.09	4.52	5.44	3.9
6.484	0	-0.04	0	0.1	5.46	6.65	4.75
7.484	0.01	-0.07	-0.04	0.15	6.38	7.74	5.48
8.584	0.03	-0.1	-0.07	0.18	7.36	8.99	6.37
9.384	0.07	-0.12	-0.1	0.21	8.15	10	7.08
10.384	0.09	-0.15	-0.15	0.21	9.05	11.23	8.08
11.384	0.12	-0.17	-0.17	0.23	9.97	12.32	8.75
12.484	0.12	-0.15	-0.15	0.23	10.79	13.43	9.69
13.984	0.14	-0.14	-0.14	0.25	12	15.03	10.7
14.484	0.12	-0.15	-0.14	0.25	12.5	15.72	11.21
15.384	0.17	-0.14	-0.14	0.26	13.16	16.58	11.81
16.584	0.23	-0.14	-0.15	0.26	14.28	18.17	12.96
17.484	0.29	-0.07	-0.14	0.31	14.99	19.04	13.56
18.684	0.37	-0.01	-0.14	0.34	16.07	20.47	14.56
19.484	0.4	-0.01	-0.12	0.34	16.8	21.44	15.24
20.484	0.48	0.01	-0.12	0.37	17.73	22.7	16.12
21.584	0.56	0.07	-0.14	0.39	18.78	24.1	17.1
22.384	0.65	0.07	-0.12	0.43	19.85	25.5	18.07
23.484	0.78	0.14	-0.1	0.48	21.07	27.13	19.19
24.284	0.87	0.12	-0.1	0.53	22.2	28.65	20.24
24.584	0.89	0.14	-0.1	0.54	22.5	29.06	20.52
25.484	1.02	0.15	-0.1	0.59	23.76	30.77	21.68
26.484	1.22	0.15	-0.07	0.67	25.5	33.09	23.23
27.584	1.36	0.17	-0.09	0.73	26.81	34.83	24.39
28.584	1.6	0.21	-0.04	0.81	28.95	37.54	26.16
28.584	1.72	0.21	-0.03	0.84	29.46	38.13	26.64
23.684	2.7	0.65	-0.06	0.91	34.91	40.43	25.97
22.084	4.36	0.64	-0.14	0.95	39.43	43.14	26.67
19.684	5.68	0.36	-0.39	1.02	43.26	45.71	26.97
18.784	6.93	0.32	-0.54	1.11	46.18	47.6	27.47
18.584	6.98	0.31	-0.56	1.09	46.23	47.55	27.4

Specimen: SDP-1.0-PLY-9.5 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
3.03	0.16	0.03	0.02	0.03	1.14	1.39	1.07
4.03	0.14	0.03	0.05	0.05	2.45	3	2.16
5.13	0.13	0.03	0.04	0.08	3.49	4.23	3.07
6.03	-0.68	0.06	0.05	0.13	4.56	5.59	3.91
8.03	0.24	0	0.05	0.14	6.62	7.98	5.46
9.03	0.27	-0.03	0.05	0.14	7.59	9.21	6.27
10.73	-0.21	-0.05	0.07	0.16	9.02	11.05	7.56
11.43	0.06	-0.06	0.09	0.16	9.25	11.27	7.72
13.03	-0.51	-0.05	0.14	0.17	10.36	13.4	9.21
14.13	-0.73	-0.06	0.16	0.14	11.1	14.53	9.88
15.03	-3.25	-0.05	0.18	0.13	11.7	15.34	10.53
16.03	-2.93	-0.03	0.21	0.08	12.43	16.38	11.24
17.03	-4.07	-0.05	0.25	0.03	13.2	17.44	11.98
18.03	-3.47	-0.03	0.25	0.03	13.93	18.44	12.73
19.03	-0.76	0	0.32	0.03	14.7	19.53	13.47
20.03	-0.44	0.03	0.37	0.03	15.54	20.7	14.31
20.93	-0.38	0.03	0.37	0.05	16.26	21.74	15.05
22.03	-0.57	0.09	0.46	0.03	17.2	23	15.86
22.93	-1.85	0.11	0.47	0.05	17.98	24.13	16.6
24.03	-3.13	0.09	0.51	0.05	18.79	25.32	17.44
25.03	-4.06	0.11	0.55	0.05	19.63	26.42	18.18
26.03	-3.41	0.08	0.6	0.06	20.51	27.45	19.06
26.93	3.68	0.09	0.6	0.06	21.3	28.52	19.83
27.33	-3.43	0.06	0.63	0.06	21.62	28.97	20.16
27.63	0.32	0.08	0.63	0.14	21.95	29.46	20.51
27.63	-0.43	0.09	0.65	0.16	21.98	29.49	20.48
27.53	0.13	0.08	0.63	0.14	21.98	29.49	20.54
27.53	-0.63	0.08	0.65	0.13	21.96	29.46	20.51
27.53	-0.06	0.08	0.63	0.14	22	29.55	20.51
27.53	-1.58	0.06	0.65	0.13	22	29.52	20.51
27.53	-2.08	0.08	0.63	0.13	22	29.49	20.51
27.53	-0.93	0.08	0.63	0.14	21.98	29.49	20.51
27.13	-1.06	-0.09	0.6	0.21	21.66	29.01	20.22
28.13	-0.57	-0.11	0.63	0.22	22.47	30.04	20.96
29.23	-0.16	-0.13	0.63	0.22	23.32	31.33	21.83
29.93	-0.38	-0.14	0.67	0.22	23.95	32.2	22.42
31.23	0.58	-0.17	0.7	0.27	25.12	33.88	23.61
32.43	-1.11	-0.19	0.74	0.35	26.32	35.56	24.77
32.93	-0.66	-0.19	0.83	0.36	26.94	36.43	25.42
33.93	0.43	-0.21	0.91	0.47	28.52	38.34	26.68
34.13	0.44	-0.22	0.95	0.51	28.45	38.63	26.91
35.13	-0.71	-0.24	1.02	0.6	30.03	40.89	23.39
36.13	-0.74	-0.3	1.18	0.66	31.96	43.57	30.23
29.23	1.72	0.24	1.3	0.81	38.53	45.22	29.52
29.13	1.75	0.24	1.3	0.81	38.56	45.19	29.49

Specimen: SDP-1.0-PLY-9.5 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.13	-0.43	0.02	0	0.02	0	0	0
12.13	-0.14	0.39	0.07	0.17	10.15	13.21	8.98
12.83	-0.73	0.39	0.12	0.19	10.6	13.76	9.3
12.73	-0.54	0.38	0.11	0.22	10.56	13.7	9.37
14.63	-0.55	0.41	0.11	0.3	11.81	15.5	10.53
15.93	-0.52	0.41	0.11	0.36	12.77	16.89	11.56
16.73	-0.54	0.41	0.09	0.36	13.37	17.73	12.14
17.53	-0.71	0.43	0.14	0.41	13.91	18.54	12.63
18.83	-0.13	0.51	0.18	0.47	14.87	19.9	13.53
19.33	-0.19	0.55	0.21	0.47	15.3	20.51	14.02
19.73	0.03	0.6	0.21	0.52	15.58	20.9	14.21
20.43	-0.09	0.6	0.25	0.54	16.12	21.64	14.73
21.83	-0.06	0.69	0.3	0.6	17.32	23.29	15.89
22.73	0	0.73	0.32	0.65	18.02	24.26	16.6
23.33	0	0.77	0.33	0.69	18.54	25	17.05
24.33	-0.71	0.84	0.33	0.74	19.37	26.2	17.93
24.43	-0.71	0.84	0.33	0.77	19.5	23.36	18.02
24.73	-0.66	0.85	0.33	0.77	19.77	26.74	18.28
24.93	-0.62	0.87	0.37	0.79	19.94	26.97	18.44
25.63	-0.63	0.92	0.4	0.81	20.46	27.68	18.96
25.63	-0.55	0.92	0.4	0.85	20.57	27.84	19.02
25.63	-0.62	0.93	0.42	0.85	20.57	27.91	19.06
25.53	-0.69	0.95	0.44	0.85	20.59	27.84	19.02
27.23	-0.67	1.03	0.48	0.93	21.95	29.75	20.34
27.63	-0.71	1.04	0.49	0.94	22.33	30.33	20.73
28.63	-0.74	1.11	0.58	1.01	23.23	31.52	21.6
29.53	-0.75	1.16	0.62	1.06	24.16	32.88	22.54
30.43	-0.78	1.19	0.72	1.13	25.18	34.36	23.54
30.53	-0.88	1.27	0.7	1.15	25.33	34.59	23.74
31.53	-0.8	1.38	0.84	1.28	26.54	36.5	25.06
32.43	-0.85	1.5	0.95	1.39	27.82	38.4	26.35
32.43	-0.8	1.52	0.93	1.39	27.84	38.4	26.42
33.53	-0.82	1.71	1.11	1.56	29.73	41.24	28.42

Specimen: SDP-1.0-PLY-12.7 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.118	0.03	0.01	0.01	0.03	-0.01	-0.01	0
3.218	-0.39	0.03	0.02	0.06	2.26	3.74	2.66
4.118	-0.48	0.03	0.28	0.07	3.27	4.3	3.74
5.618	-0.56	0.03	0.32	0.12	4.64	5.8	5.02
6.118	-0.56	0.03	0.36	0.14	5.09	6.54	5.41
7.118	-0.56	0.01	0.39	0.15	5.99	7.57	6.16
8.018	-0.56	0.03	0.4	0.15	6.82	8.48	6.88
9.018	-0.37	0.1	0.58	0.29	7.98	10.15	7.96
9.118	-0.56	0.03	0.43	0.15	7.73	9.96	7.96
10.018	-0.39	0.1	0.59	0.26	8.63	11.02	8.58
10.118	-0.56	0.03	0.45	0.15	8.6	11.13	8.75
11.318	-0.4	0.09	0.58	0.23	9.56	12.23	9.42
12.118	-0.37	0.14	0.59	0.25	10.14	14.08	9.95
13.218	-0.37	0.15	0.64	0.25	11.01	14.26	10.74
14.118	-0.37	0.17	0.69	0.23	11.79	15.13	11.45
15.118	-0.36	0.21	0.73	0.25	12.51	16.61	12.06
16.318	-0.29	0.23	0.76	0.26	13.38	17.18	12.81
17.018	-0.28	0.23	0.81	0.26	13.9	17.95	13.24
18.118	-0.23	0.21	0.81	0.28	14.68	18.96	14.06
19.318	-0.2	0.2	0.84	0.28	15.63	20.53	14.93
20.118	-0.18	0.18	0.86	0.29	16.21	21.08	15.52
21.318	-0.18	0.2	0.87	0.29	17.27	22.22	16.63
21.918	-0.21	0.2	0.86	0.29	17.79	23.26	17.14
22.618	-0.32	0.23	0.89	0.32	18.33	24.09	17.69
23.118	-0.36	0.23	0.89	0.32	18.08	24.76	18.18
24.218	-0.59	0.29	0.87	0.32	19.61	25.9	19.01
25.018	-0.81	0.5	0.91	0.37	20.3	26.89	19.71
26.218	-1.14	0.53	0.91	0.4	21.36	28.39	20.8
27.418	-1.55	0.61	0.95	0.48	22.42	29.92	21.91
28.518	-1.89	0.7	0.97	0.54	23.45	31.41	22.98
29.218	-2.16	0.86	0.98	0.58	24.19	32.48	23.74
29.918	-2.43	0.89	1	0.65	24.95	33.59	24.54
30.318	-2.6	0.92	1	0.69	25.48	34.35	25.09
31.118	-2.79	0.97	1	0.7	26.19	35.38	25.83
32.218	-3.21	1.13	1.02	0.76	27.5	37.3	27.21
33.018	-3.43	1.16	1.02	0.87	28.55	38.87	28.33
34.118	-3.46	1.27	1.02	1	30.08	41.18	29.92
34.918	-3.45	1.33	1.02	1.16	31.55	43.38	31.46
35.818	-3.42	1.35	1.03	1.31	33.21	45.68	33.17
35.918	-3.39	1.33	1.03	1.36	33.61	46.42	33.57
36.118	-3.39	1.3	1.02	1.41	34.13	47.18	34.1
36.418	-3.39	1.27	1.06	1.44	34.51	48.02	34.64
36.918	-3.39	1.3	1.14	1.57	35.61	49.56	35.8
35.418	-3.46	1.35	1.61	2.22	36.6	52.34	40.67
34.518	-3.48	1.33	1.85	2.3	36.38	52.25	41.04
33.218	-3.57	1.33	2.22	2.37	35.95	52	41.83
30.518	-3.83	1.3	2.95	2.57	35.4	52.2	43.78

Specimen: SDP-1.0-PLY-12.7 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.118	0.01	0.01	0.01	0	0	-0.01	0
2.418	0.06	0.03	0.03	0.04	1.56	1.83	1.43
3.218	0.04	0.03	0.03	0.06	2.46	2.86	2.21
4.018	0.07	0.03	0.04	0.06	3.38	3.92	3.03
5.118	0.09	0.04	0.07	0.09	4.44	5.23	4.05
6.218	0.14	0.04	0.1	0.12	5.52	6.59	5.1
7.118	0.18	0.03	0.12	0.14	6.39	7.68	5.89
8.118	0.25	0.03	0.15	0.12	7.39	8.9	6.72
9.218	0.32	-0.01	0.17	0.1	8.5	10.25	7.64
10.018	0.37	-0.06	0.17	0.1	9.36	11.36	8.39
11.118	0.45	-0.09	0.2	0.14	10.3	12.59	9.21
12.018	0.48	-1	0.18	0.2	11.17	13.74	9.97
13.118	0.53	-0.12	0.2	0.28	12.07	14.9	10.75
14.018	0.59	-0.14	0.21	0.4	13.02	16.13	11.57
15.218	0.64	-0.18	0.21	0.51	13.94	17.34	12.38
16.018	0.69	-0.2	0.21	0.61	14.56	18.15	12.94
17.218	0.72	-0.25	0.21	0.67	15.4	19.22	13.67
18.118	0.75	-0.28	0.2	0.75	16.09	20.17	14.34
19.118	0.81	-0.28	0.21	0.89	17.01	21.44	15.2
20.118	0.87	-0.31	0.21	0.97	17.88	21.25	15.98
21.218	0.89	-0.31	0.23	1.06	18.9	23.98	16.9
22.118	0.94	-0.31	0.23	1.14	19.74	25.09	17.65
23.218	0.98	-0.29	0.25	1.25	20.82	26.55	18.61
24.218	1	-0.29	0.25	1.31	21.76	27.85	19.46
25.118	1.03	-0.29	0.25	1.41	22.71	29.13	20.33
26.118	1.06	-0.26	0.28	1.52	23.71	30.54	21.26
27.118	1.06	-0.29	0.31	1.61	24.74	31.93	22.2
28.218	1.14	-0.26	0.37	1.75	26.03	33.72	23.41
29.118	1.16	-0.25	0.43	1.89	27.17	35.24	24.44
30.018	1.16	-0.17	0.5	2.07	28.51	37.15	25.76
31.018	1.17	-0.06	0.51	2.22	29.99	39.21	27.14
32.018	1.13	-0.01	0.58	2.38	31.74	41.67	28.76
33.018	1.11	0.06	0.7	2.52	33.36	43.98	30.26
33.918	1.09	0.14	0.78	2.7	35.06	46.38	31.84
33.318	0.65	0.31	0.95	2.85	37.81	48.8	33.38
33.018	0.65	0.32	0.97	2.85	37.91	48.73	33.27
28.918	1.24	0.65	1.13	2.85	41.03	48.16	31.68
26.718	3.5	0.76	1.35	2.87	42.83	48.76	31.15
26.218	3.83	0.76	1.38	2.84	43.85	49.4	31.23

Specimen: SDP-1.0-PLY-18 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.569	0.03	0.03	0.01	0.04	-0.01	-0.01	-0.01
2.669	0.07	0.06	0.07	0.03	1.18	1.45	1.18
3.669	0.12	0.17	0.2	-0.04	2.27	2.81	2.32
4.569	0.18	0.25	0.28	-0.1	3.23	4.02	3.33
5.569	0.23	0.34	0.21	-0.25	4.3	5.4	4.49
6.669	0.29	0.47	0.23	-0.25	5.44	6.87	5.63
7.569	0.32	0.5	0.23	-0.23	6.03	7.66	6.25
8.569	0.36	0.53	0.21	-0.23	6.8	8.7	7.06
9.469	0.4	0.53	0.23	-0.21	7.39	9.5	7.66
10.769	0.45	0.56	0.21	-0.21	8.26	10.63	8.48
11.669	0.5	0.59	0.21	-0.2	9	11.61	9.19
12.669	0.54	0.62	0.21	-0.2	9.8	12.68	9.95
13.669	0.59	0.67	0.23	-0.2	10.48	13.54	10.52
14.569	0.62	0.72	0.2	-0.18	11.2	14.44	11.14
15.569	0.7	0.8	0.17	-0.18	11.97	15.42	11.8
16.569	0.72	0.84	0.17	-0.17	12.78	16.47	12.51
17.469	0.73	0.86	0.17	-0.17	13.44	17.32	13.04
18.569	0.75	0.86	0.15	-0.17	14.21	18.37	13.75
19.569	0.73	0.86	0.17	-0.2	14.87	19.2	14.32
20.569	0.75	0.87	0.17	-0.2	15.64	20.22	15.02
21.569	0.75	0.87	0.15	-0.23	16.38	21.36	15.84
22.569	0.76	0.94	0.17	-0.26	17.06	22.1	16.26
23.569	0.78	1	0.17	-0.28	17.85	23.18	17.01
24.669	0.8	1.06	0.18	-0.26	18.59	24.24	17.73
25.569	0.86	1.13	0.21	-0.29	19.28	25.2	18.41
26.569	0.89	1.19	0.25	-0.32	20.06	26.32	19.18
27.669	0.95	1.27	0.29	-0.34	20.95	27.58	20.05
28.569	1	1.35	0.32	-0.37	21.75	28.7	20.82
29.569	1.05	1.42	0.34	-0.39	22.49	29.74	21.55
30.569	1.09	1.55	0.4	-0.39	23.63	31.36	22.66
31.469	1.17	1.64	0.43	-0.37	24.1	32.05	23.13
32.469	1.27	1.72	0.5	-0.42	24.96	33.22	23.94
33.469	1.3	1.83	0.51	-0.4	25.89	34.53	24.85
34.569	1.38	1.96	0.56	-0.42	27.06	36.31	26.1
35.269	1.44	2.05	0.58	-0.4	26.76	37.06	26.63
36.769	1.57	2.26	0.67	-0.36	29.28	39.34	28.21
37.669	1.63	2.37	0.72	-0.31	30.32	40.82	29.25
38.469	1.71	2.46	0.78	-0.26	31.39	42.35	30.31
38.669	1.77	2.57	0.84	-0.21	31.98	43.23	30.97
39.569	1.85	2.74	0.89	-0.17	33.08	44.71	31.93
40.469	1.97	3.01	1.02	-0.01	34.76	47.21	33.68
40.669	2.02	3.17	1.06	0.03	35.38	48.07	34.25
40.369	2.02	3.26	1.06	0.07	36.03	48.93	34.78
40.169	2.07	3.46	1.08	0.06	36.34	49.16	34.78
40.469	2.22	3.81	1.13	0.15	38.15	51.47	36.1
39.669	2.63	4.22	1.17	0.26	40.29	53.75	36.93
36.969	3.42	5.54	1.11	0.23	44.5	57.86	37.98
30.369	4.06	8.57	0.91	0.15	49.81	62.64	38.43

Specimen: SDP-1.0-PLY-18 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.569	0.04	0.04	0.03	0.03	-0.01	-0.01	-0.02
2.569	0.03	-0.03	-0.01	0.04	1.16	1.47	1.32
3.569	0.03	-0.04	0.03	0.01	2.15	2.7	2.34
4.569	0.09	-0.04	0.06	0.01	3.1	3.89	3.29
5.569	0.15	-0.06	0.07	0	4.05	5.07	4.22
6.669	0.23	-0.04	0.1	0.01	5.09	6.37	5.23
7.569	0.29	-0.01	0.14	0.03	5.99	7.46	6.07
8.569	0.34	-0.01	0.14	0	6.78	8.45	6.84
9.469	0.39	0.01	0.17	-0.03	7.54	9.41	7.56
10.569	0.42	0.03	0.18	-0.01	8.33	10.44	8.29
11.569	0.47	0.04	0.18	0	9.14	11.49	9.04
12.569	0.48	0.07	0.14	0.01	9.93	12.52	9.76
13.669	0.53	0.1	0.12	0.03	10.78	13.61	10.5
14.569	0.56	0.12	0.12	0.03	11.56	14.62	11.19
15.569	0.56	0.17	0.1	0.04	12.46	15.83	12.03
16.569	0.62	0.28	0.17	0.1	13.23	16.84	12.76
17.669	0.62	0.28	0.18	0.1	13.96	17.89	13.53
18.569	0.62	0.29	0.17	0.14	14.57	18.73	14.15
19.569	0.62	0.28	0.2	0.18	15.21	19.64	14.68
20.569	0.64	0.32	0.25	0.23	15.88	20.6	15.37
21.669	0.64	0.36	0.25	0.23	16.67	21.72	16.18
22.569	0.65	0.39	0.25	0.23	17.32	22.65	16.88
23.569	0.69	0.47	0.28	0.25	18.03	23.67	17.62
24.469	0.73	0.51	0.28	0.31	18.76	24.72	18.36
25.469	0.8	0.59	0.29	0.37	19.54	25.85	19.17
26.569	0.81	0.64	0.28	0.4	20.34	26.99	19.99
27.569	0.89	0.72	0.29	0.47	21.11	28.09	20.77
28.569	0.97	0.78	0.29	0.53	21.9	29.25	21.62
29.469	1.03	0.84	0.31	0.58	22.6	30.27	22.34
30.569	1.09	0.89	0.31	0.61	23.38	31.39	23.15
31.569	1.17	0.97	0.34	0.65	24.23	32.63	24.04
32.669	1.25	1.02	0.34	0.72	25.07	33.87	24.94
33.469	1.3	1.06	0.32	0.75	25.79	34.92	25.71
34.569	1.41	1.16	0.34	0.83	26.67	36.21	26.64
34.969	1.41	1.17	0.34	0.84	27.05	36.78	27.1
35.769	1.46	1.2	0.31	0.89	27.88	38	27.94
36.669	1.5	1.27	0.28	0.94	28.82	39.45	29
37.569	1.61	1.35	0.23	1.02	29.72	40.86	30.05
38.669	1.72	1.44	0.14	1.09	30.41	41.87	30.79
39.669	1.74	1.47	0.07	1.17	31.48	43.34	31.83
39.869	1.78	1.52	-0.01	1.24	32.4	44.85	32.99
40.869	1.89	1.63	-0.01	1.33	33.15	46.06	33.92
41.669	1.97	1.72	0.03	1.46	34.22	47.42	34.83
42.269	2.04	1.78	0.07	1.55	35.31	49.04	35.95
42.569	2.13	1.82	0.18	1.64	36.23	50.54	37.08
43.269	2.27	1.93	0.36	1.75	37.18	51.79	37.94
43.969	2.29	1.97	0.59	1.88	38.16	53.16	38.91
43.569	2.38	2.07	0.97	2.35	37.79	54.6	43.68
37.869	2.35	2.08	1.67	3.53	38.4	56.05	45.41
37.769	2.32	2	1.85	3.72	38.32	56.07	45.73
36.669	2.3	2.02	1.96	4.27	38.58	57.29	47.88
36.369	2.32	2.02	1.97	4.33	38.51	57.25	47.96

Specimen: SDP-1.2-PLY-9.5 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.069	-0.47	0	0.02	0	0.02	0	-0.03
1.069	-0.38	0	0.02	0.02	0.02	0	-0.03
1.069	-0.38	0	0.02	0	0	0	-0.03
1.069	-0.47	-0.03	0.04	0.02	0.03	0.03	-0.03
3.169	-0.55	-0.03	-0.02	-0.02	1.88	2.23	1.78
4.469	-0.68	-0.03	-0.07	0.02	3.14	3.78	2.84
5.069	-0.74	-0.03	-0.09	0.02	3.66	4.36	3.23
6.369	-0.77	-0.02	-0.11	0.02	4.88	5.91	4.23
6.969	-0.79	-0.03	-0.12	0.02	5.48	6.62	4.72
8.069	-0.9	-0.03	-0.16	0.03	6.49	7.82	5.52
9.269	-0.99	-0.02	-0.18	0.03	7.55	9.04	6.36
9.869	-1.04	-0.03	-0.23	0	8.18	9.82	6.82
10.969	-1.06	-0.05	-0.28	0.02	9.06	10.92	7.56
11.869	-1.15	-0.05	-0.03	0.02	9.71	11.69	8.11
11.869	-1.15	-0.05	-0.33	0.03	9.7	11.69	8.11
11.869	-1.03	-0.05	-0.32	0.02	9.68	11.69	8.07
12.569	-1.12	-0.05	-0.35	0.05	10.18	12.31	8.49
14.069	-1.12	-0.03	-0.39	0.08	11.2	13.57	9.33
14.169	-1.15	-0.06	-0.39	0.09	11.32	13.76	9.46
14.269	-1.03	-0.05	-0.42	0.09	11.38	13.82	9.56
15.269	-1.12	-0.05	-0.42	0.14	11.94	14.57	10.01
15.969	-1.14	-0.05	-0.46	0.17	12.32	15.12	10.37
16.969	-0.99	-0.06	-0.49	0.22	12.98	15.92	10.95
18.069	-0.93	-0.08	-0.55	0.24	13.6	16.76	11.43
19.069	-0.9	-0.08	-0.58	0.28	14.23	17.7	12.05
20.169	-0.81	-0.08	-0.62	0.3	14.89	18.51	12.53
21.269	-0.65	-0.08	-0.65	0.35	15.62	19.48	13.21
22.169	-0.47	-0.09	-0.69	0.39	16.17	20.28	13.6
23.169	-0.33	-0.11	-0.7	0.43	16.45	21.19	14.18
24.169	-0.24	-0.11	-0.76	0.49	17.12	22.06	14.76
25.769	-0.27	0.09	-0.79	0.55	18.3	23.71	15.89
26.969	-0.09	-0.11	-0.86	0.65	19.07	24.64	16.6
27.969	0	-0.09	-0.88	0.69	19.74	25.61	17.02
28.869	0.03	-0.11	-0.09	0.73	20.43	26.49	17.6
29.869	0.13	-0.13	0.93	0.79	21.08	27.39	18.28
30.669	0.09	-0.11	-0.95	0.85	21.71	28.26	18.86
31.569	0.25	-0.09	-0.99	0.88	22.36	29.13	19.48
32.469	0.3	-0.09	-1	0.95	23.02	30.07	20.06
33.369	0.38	-0.09	-1.04	0.99	23.69	30.91	20.64
34.469	0.36	-0.08	-1.06	1.06	24.51	31.98	21.41
35.069	0.55	-0.03	-1.07	1.14	24.96	32.69	21.77
35.969	0.62	-0.03	-1.13	1.18	25.61	33.5	22.35
36.869	0.66	0	-1.18	1.22	26.31	34.46	23
37.569	0.69	0.02	-1.2	1.25	26.91	35.34	23.55
38.469	0.71	0.06	-1.23	1.29	27.54	36.11	24.06
39.169	0.96	0.09	-1.25	1.34	28.15	36.98	24.71
39.969	1.06	0.13	-1.27	1.41	28.83	37.86	25.29
40.769	0.98	0.16	-1.3	1.47	29.46	38.73	25.87
41.669	1.2	0.19	-1.35	1.52	30.24	39.79	26.65
42.969	1.2	0.25	-1.39	1.61	31.36	41.28	27.65
42.869	1.22	0.27	-1.41	1.64	31.37	41.25	27.62
43.669	1.34	0.3	-1.41	1.67	32.01	42.09	28.23
44.469	1.45	0.33	-1.44	1.71	32.64	42.93	28.84

44.769	1.63	0.38	-1.46	1.77	33.24	43.64	29.23
46.469	1.83	0.46	-1.55	1.88	35.02	46.03	30.94
46.869	2.08	0.55	-1.55	1.97	35.83	46.93	31.43
47.469	2.42	0.68	-1.62	2.07	37.25	48.48	32.49
47.669	2.57	0.79	-1.64	2.12	38.34	49.42	33.11
37.669	4.63	1.58	-1.81	2.16	43.99	48.77	30.56
36.169	4.71	1.75	-1.81	2.16	45.13	48.97	30.33
35.569	4.52	1.83	-1.79	2.16	45.36	48.93	30.2
35.169	5.1	1.88	-1.79	2.18	45.55	48.9	30.07

Specimen: SDP-1.2-PLY-9.5 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.069	0.32	0.02	0.02	-0.02	0.02	0.03	0.03
1.069	0.33	0	0.02	-0.02	0.02	0	0
7.469	-0.03	-0.02	0	0.03	5.86	7.75	5.91
13.169	-0.05	0.02	-0.12	0	10.15	13.24	9.79
14.069	-0.17	0.03	-0.12	0.02	10.86	14.21	10.37
15.669	-0.17	0.06	-0.14	0.06	11.8	15.47	11.3
16.069	-0.16	0.08	-0.12	0.08	11.98	15.67	11.43
16.369	-0.16	0.06	-0.14	0.06	12.24	16.02	11.72
18.069	-0.13	0.09	-0.16	0.09	13.2	17.38	12.6
17.969	-0.16	0.08	-0.16	0.11	13.2	17.38	12.6
18.769	-0.16	0.08	-0.16	0.11	13.71	18.06	13.05
18.969	-0.25	0.08	-0.16	0.13	13.78	18.18	13.21
19.169	0.13	0.08	-0.16	0.11	13.88	18.28	13.28
19.369	-0.27	0.08	-0.16	0.11	14.04	18.48	13.44
19.969	-0.02	0.08	-0.16				
20.069	-1.47	0.08	-0.14	0.16	14.48	19.12	13.86
21.469	-1.71	0.09	-0.14	0.19	15.33	20.35	14.66
22.569	0.21	0.09	-0.12	0.24	15.95	21.25	15.31
22.669	0.24	0.11	-0.18	0.24	15.98	21.22	15.31
23.969	-0.09	0.14	-0.12	0.28	16.77	22.35	16.12
24.669	-0.22	0.16	-0.14	0.3	17.27	23.13	16.63
25.269	-0.13	0.17	-0.12	0.32	17.64	23.61	16.93
25.569	-0.19	0.17	-0.12	0.33	17.83	23.9	17.21
26.069	0.06	0.19	-0.11	0.38	18.05	24.39	17.47
26.569	0.06	0.21	-0.21	0.39	18.27	24.71	17.7
27.469	0.25	0.21	-0.14	0.43	18.93	25.65	18.35
27.469	0.28	0.24	-0.14	0.44	18.95	25.65	18.35
28.469	-0.02	0.25	-0.12	0.51	19.56	26.52	18.93
28.469	-0.09	0.25	-0.12	0.47	19.56	26.52	18.9
28.769	0.22	0.24	-0.14	0.54	19.78	26.81	19.09
29.369	0.28	0.25	-0.12	0.57	20.16	27.36	19.51
29.669	0.06	0.25	-0.14	0.58	20.38	27.68	19.74
30.269	-0.43	0.25	-0.11	0.62	20.78	28.26	20.12
30.469	-1.12	0.28	-0.12	0.65	20.95	28.49	20.25
31.169	-0.54	0.28	-0.11	0.71	21.38	29.07	20.7
31.469	-1.29	0.28	-0.12	0.73	21.63	29.43	21.03
32.069	-0.66	0.3	-0.12	0.77	22.01	29.94	21.35
32.969	-1.42	0.32	-0.12	0.81	22.64	30.81	21.96
33.469	-0.73	0.33	-0.12	0.82	23.07	31.43	22.35
33.769	-1.61	0.32	-0.14	0.84	23.27	31.69	22.58
35.269	-0.09	0.38	-0.12	0.9	24.4	33.33	23.68
35.469	-0.21	0.38	-0.12	0.93	24.59	33.62	23.9
36.169	-0.17	0.38	-14	0.98	25.01	34.24	24.29

36.269	-0.21	0.39	-0.12	0.99	25.17	34.4	24.45
36.969	-0.17	0.39	-0.11	1.01	25.63	35.08	24.9
37.369	-0.17	0.43	-0.12	1.04	25.99	35.56	25.32
38.469	0.25	0.44	-0.11	1.14	26.84	36.73	26.03
39.269	0.28	0.46	-0.07	1.22	27.59	37.76	26.81
40.469	0.02	0.51	-0.04	1.31	28.61	39.21	27.84
41.169	-0.06	0.51	-0.02	1.36	29.18	40.02	28.46
41.069	-0.06	0.54	0	1.34	29.23	40.12	28.49
41.769	-0.02	0.55	0.02	1.44	29.78	40.76	29.04
41.769	-0.02	0.57	0.02	1.44	29.83	41.05	29.2
42.169	0.02	0.58	0.04	1.5	30.25	41.6	29.65
42.069	0	0.57	0.05	1.5	30.29	41.6	29.62
42.769	0.08	0.6	0.04	1.58	30.98	42.51	30.33
43.069	-0.06	0.6	0.05	1.61	31.41	43.06	30.78
42.869	0.27	0.63	0.05	1.63	31.47	43.12	30.85
43.069	0.52	0.62	0.04	1.67	32.04	43.7	31.36
43.269	0.58	0.66	0.05	1.74	32.72	44.35	31.82
41.169	0.87	0.77	0.11	1.82	34.36	44.35	31.94
38.169	1.23	0.92	0.18	1.8	35.5	43.86	31.56
35.469	1.53	1.04	0.23	1.8	36.59	43.54	31.4
30.569	1.91	1.29	0.35	1.82	39.81	43.8	31.27
30.369	1.58	1.34	0.33	1.82	40.28	43.99	31.33

Specimen: SDP-1.2-PLY-12.7 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.53	0.01	0.01	0.03	0.01	-0.03	0	0
2.63	-0.03	0.03	0.04	0.04	1.04	1.25	0.91
3.53	-0.03	0.06	0.07	0.06	1.89	2.27	1.63
4.53	-0.04	0.06	0.09	0.1	2.8	3.34	2.4
5.53	-0.04	0.07	0.14	0.17	3.67	4.38	3.15
6.53	-0.07	0.09	0.17	0.25	4.52	5.44	3.9
7.53	-0.06	0.12	0.21	0.31	5.29	6.43	4.61
8.53	-0.06	0.12	0.23	0.34	5.92	7.22	5.18
9.43	-0.04	0.14	0.26	0.36	6.44	7.89	5.65
10.53	-0.01	0.14	0.29	0.37	7.13	8.8	6.29
11.53	0	0.14	0.31	0.39	7.76	9.63	6.89
12.53	0	0.1	0.31	0.42	8.44	10.54	7.53
13.53	0	0.1	0.34	0.47	9.08	11.42	8.15
14.53	0.01	0.09	0.37	0.5	9.87	12.37	8.83
15.53	0.01	0.07	0.37	0.51	10.49	13.33	9.5
16.43	0.03	0.06	0.39	0.54	11.1	14.16	10.09
17.53	0.03	0.04	0.42	0.62	11.88	15.22	10.84
18.53	0.03	0.03	0.4	0.62	12.46	16.07	11.44
19.73	0.03	0.03	0.42	0.69	13.21	17.08	12.15
20.43	0.04	0.03	0.42	0.73	13.6	17.6	12.53
21.43	0.04	0	0.45	0.78	14.16	18.39	13.07
22.53	0.04	0	0.43	0.84	14.77	19.24	13.64
23.43	0.06	0	0.45	0.91	15.34	20.01	14.15
24.43	0.04	0	0.45	0.94	15.93	20.83	14.71
25.53	0.03	0.01	0.47	0.98	16.58	21.71	15.31
26.53	0.03	0.04	0.47	1.03	17.25	22.63	15.95
27.53	0.04	0.07	0.48	1.09	17.84	23.46	16.53
28.53	0.01	0.09	0.48	1.16	18.48	24.37	17.16
29.53	0.03	0.14	0.5	1.24	19.11	25.26	17.79
30.53	0.01	0.17	0.48	1.27	19.71	26.11	18.39
31.53	0	0.21	0.51	1.39	20.45	27.17	19.13

32.53	0	0.25	0.5	1.57	21.07	28.05	19.75
33.43	0.01	0.29	0.5	1.57	21.63	28.85	20.33
34.53	0.01	0.32	0.5	1.63	22.38	29.97	21.14
35.43	0.01	0.37	0.53	1.74	22.98	30.77	21.65
36.53	0.01	0.42	0.51	1.82	23.69	31.78	22.36
37.43	0.03	0.47	0.51	1.89	24.34	32.72	23.01
38.33	0	0.51	0.53	2.02	25.06	33.74	23.73
39.53	0	0.56	0.53	2.1	25.77	34.76	24.45
40.53	0	0.61	0.53	2.24	25.89	35.85	25.22
41.53	0	0.64	0.53	2.32	26.51	36.72	25.83
42.53	0	0.69	0.53	2.44	27.28	37.8	26.6
43.43	-0.03	0.73	0.51	2.55	28.01	38.83	27.28
44.53	-0.03	0.76	0.5	2.66	28.83	39.99	28.09
44.93	-0.03	0.8	0.5	2.71	29.23	40.56	28.5
45.53	-0.03	0.83	0.5	2.81	29.9	41.5	29.17
46.33	-0.01	0.84	0.5	2.9	30.35	42.11	29.62
47.63	-0.03	0.89	0.5	3.01	31.24	43.36	30.5
47.63	-0.01	0.89	0.48	3.06	31.6	43.91	30.89
48.43	-0.03	0.92	0.48	3.15	32.11	44.53	31.34
48.83	-0.03	0.94	0.48	3.2	32.54	45.11	31.76
49.83	-0.01	1	0.47	3.26	33.43	46.3	32.62
50.03	-0.03	1	0.47	3.28	33.88	46.86	33.02
50.33	-0.03	1.05	0.45	3.13	34.32	47.44	33.43
50.73	-0.01	1.09	0.45	3.39	35.15	48.47	34.15
50.93	-0.01	1.11	0.43	3.39	35.52	48.91	34.46
51.43	0	1.17	0.43	3.42	36.48	49.99	35.21
44.33	0.37	1.5	0.37	3.48	41	50.02	34.02
43.43	0.2	1.49	0.34	3.46	41.41	49.95	33.85
42.83	0.2	1.52	0.36	3.48	41.59	49.88	33.72
42.63	0.2	1.5	0.34	3.48	42.2	50.5	34.05
39.43	0.26	1.44	0.32	3.46	46.03	51.46	33.55
37.53	0.31	1.44	0.32	3.43	46.74	51.37	33.22

Specimen: SDP-1.2-PLY-12.7 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.177	0.01	0.01	0.03	0.01	0	-0.01	-0.01
2.177	-0.06	0.01	0.01	-0.04	0.94	1.2	0.99
3.177	-0.04	0.07	0.03	-0.1	1.96	2.41	1.93
4.277	-0.04	0.15	0.04	-0.18	3	3.66	2.86
5.177	-0.06	0.17	0.04	-0.25	3.7	4.52	3.49
6.177	-0.04	0.29	0.06	-0.26	4.54	5.52	4.24
7.177	-0.04	0.28	0.06	-0.26	5.24	6.38	4.87
8.177	-0.01	0.32	0.07	-0.25	5.95	7.24	5.47
9.277	0	0.32	0.07	-0.25	6.71	8.14	6.1
10.277	-0.01	0.36	0.07	-0.26	7.49	9.07	6.73
11.077	-0.01	0.36	0.06	-0.25	8.05	9.76	7.2
12.277	-0.01	0.39	0.09	-0.25	8.88	10.79	7.9
13.177	0	0.4	0.09	-0.21	9.52	11.61	8.45
14.177	0	0.45	0.09	-0.09	10.21	12.51	9.07
15.177	0	0.48	0.09	0.04	10.85	13.34	9.64
16.177	0.01	0.51	0.1	0.29	11.56	14.24	10.28
17.177	0	0.53	0.09	0.48	12.24	15.13	10.9
18.177	-0.03	0.56	0.1	0.56	12.84	15.91	11.43
19.377	-0.03	0.58	0.1	0.64	13.53	16.81	12.05
20.077	-0.07	0.58	0.12	0.69	13.31	17.35	12.41
21.077	-0.17	0.58	0.1	0.75	13.96	18.2	12.77
22.077	-0.26	0.61	0.1	0.81	14.59	19.02	13.33

23.177	-0.39	0.64	0.12	0.86	15.32	20	13.99
24.177	-0.5	0.67	0.12	0.91	15.92	20.82	14.57
25.177	-0.59	0.69	0.14	0.95	16.53	21.65	15.15
26.177	-0.73	0.7	0.12	1.02	17.22	22.59	15.81
27.177	-0.87	0.72	0.15	1.08	17.86	23.49	16.44
28.477	-1	0.73	0.14	1.13	18.97	25.03	17.53
29.177	-1.09	0.76	0.17	1.19	19.23	25.39	17.79
29.977	-1.19	0.76	0.2	1.24	19.84	26.23	18.39
31.177	-1.28	0.81	0.21	1.31	20.66	27.37	19.2
32.277	-1.38	0.84	0.21	1.36	21.38	28.38	19.91
33.077	-1.44	0.86	0.21	1.41	21.98	29.21	20.49
34.277	-1.49	0.91	0.25	1.49	22.78	30.34	21.28
35.077	-1.52	0.94	0.26	1.53	23.49	31.32	21.99
36.177	-1.53	0.98	0.29	1.6	24.24	32.39	22.73
37.177	-1.55	1.03	0.31	1.64	24.96	33.41	23.45
38.077	-1.58	1.08	0.34	1.69	25.62	34.35	24.05
39.177	-1.61	1.16	0.36	1.75	26.47	35.55	24.89
40.177	-1.67	1.19	0.36	1.8	27.24	36.64	25.68
41.177	-1.71	1.27	0.37	1.89	28.04	37.78	26.48
42.077	-1.75	1.31	0.37	1.94	28.76	38.79	27.21
43.077	-1.8	1.35	0.39	2	29.61	39.98	28.04
44.077	-1.83	1.41	0.42	2.05	30.44	41.14	28.84
45.177	-1.89	1.47	0.4	2.1	31.45	42.55	29.82
46.177	-1.96	1.6	0.43	2.16	32.51	44.01	30.85
46.977	-2	1.63	0.43	2.18	33.27	45.04	31.58
47.877	-2.08	1.66	0.42	2.19	34.03	46.08	32.31
48.077	-2.11	1.69	0.45	2.21	34.38	45.56	32.65
48.777	-2.16	1.69	0.42	2.22	35.06	47.49	33.3
49.177	-2.22	1.72	0.45	2.26	35.68	48.3	33.87
49.777	-2.29	1.74	0.43	2.27	36.48	49.34	34.59
50.177	-2.33	1.77	0.43	2.3	37.06	50.06	35.09
49.877	-2.37	1.82	0.43	2.32	37.49	50.42	35.32
45.177	-2.29	2.51	0.43	2.32	40.32	50.24	34.31
42.377	-2.11	2.82	0.43	2.33	41.76	50.04	33.64
39.277	-1.99	3.28	0.45	2.33	44.07	49.63	32.92
37.677	-2	3.42	0.43	2.3	44.72	49.44	32.6
37.477	-2.08	3.51	0.42	2.27	45.61	49.89	32.74

Specimen: SDP-1.2-PLY-18 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.562	0.03	0.03	0.03	0.01	-0.02	-0.02	-0.01
2.962	0.28	0.1	0.1	0.1	1.14	1.64	1.32
3.562	0.31	0.07	0.09	0.1	1.6	2.24	1.79
4.462	0.34	0.1	0.1	0.14	2.31	3.14	2.46
5.562	0.36	0.1	0.1	0.15	3.17	4.21	3.28
6.462	0.34	0.09	0.09	0.2	3.82	5	3.88
7.462	0.32	0.07	0.1	0.25	4.51	5.88	4.55
8.762	0.31	0.06	0.1	0.28	5.33	6.94	5.35
9.562	0.29	0.06	0.1	0.32	5.82	7.59	5.85
10.562	0.28	0.04	0.12	0.4	6.49	8.47	6.53
11.662	0.28	0.04	0.1	0.45	7.21	9.41	7.25
12.462	0.31	0.06	0.1	0.56	7.82	10.24	7.88
13.462	0.32	0.06	0.1	0.59	8.46	11.1	8.54
15.462	0.39	0.06	0.1	0.75	9.81	12.92	9.86
15.762	0.4	0.06	0.1	0.76	9.97	13.15	10.03

16.662	0.4	0.06	0.1	0.81	9.97	13.93	10.59
17.462	0.43	0.06	0.1	0.87	10.51	14.7	11.14
18.362	0.47	0.09	0.09	0.97	11.11	15.56	11.78
19.662	0.47	0.09	0.07	1.03	11.76	16.51	12.51
20.662	0.45	0.07	0.06	1.09	12.34	17.33	13.13
21.362	0.43	0.09	0.06	1.16	12.8	17.99	13.64
22.462	0.43	0.1	0.04	1.22	13.41	18.86	14.28
23.462	0.45	0.12	0.03	1.3	13.97	19.66	14.87
24.462	0.47	0.14	0.04	1.36	14.54	20.48	15.47
25.362	0.47	0.14	0	1.42	15.11	21.28	16.06
26.362	0.51	0.18	0	1.52	15.74	22.2	16.71
27.862	0.62	0.2	0.06	1.71	16.7	23.58	17.73
29.062	0.64	0.23	0.03	1.75	17.42	24.65	18.51
29.762	0.69	0.26	0.01	1.82	17.85	25.29	18.97
30.562	0.69	0.29	0	1.86	18.41	26.12	19.59
31.862	0.72	0.31	-0.04	1.91	19.15	27.23	20.39
32.762	0.73	0.34	-0.06	1.96	19.71	28.06	21
33.562	0.8	0.4	-0.07	2.08	20.39	29.12	21.75
34.662	0.83	0.43	-0.09	2.18	21.08	30.16	22.49
35.462	0.87	0.47	-0.09	2.26	21.64	30.99	23.09
36.562	0.91	0.5	-0.1	2.35	22.33	32.04	23.83
37.662	0.95	0.54	-0.14	2.46	22.44	33.18	24.64
38.462	0.97	0.56	-0.15	2.52	22.95	33.94	25.19
39.662	1.02	0.61	-0.15	2.65	23.84	35.25	26.13
40.562	1.06	0.64	-0.15	2.76	24.44	36.14	26.76
41.562	1.09	0.69	-0.14	2.85	25.18	37.25	27.55
42.862	1.16	0.72	-0.06	2.99	26.05	38.56	28.48
43.562	1.24	0.76	0.03	3.09	26.73	39.58	29.21
44.662	1.3	0.8	0.07	3.18	27.47	40.68	29.99
45.662	1.49	0.84	0.14	3.31	28.25	41.86	30.85
46.662	1.63	0.91	0.21	3.45	29.01	43.14	31.77
47.762	1.86	0.95	0.31	3.61	30.04	44.53	32.78
48.762	1.97	1	0.39	3.78	31.14	46.19	33.99
49.362	2.07	1.05	0.48	3.97	31.85	47.33	34.91
50.662	2.15	1.11	0.56	4.11	32.76	48.62	35.79
51.562	2.22	1.17	0.67	4.41	34.08	50.71	37.43
52.462	2.35	1.25	0.83	4.8	35.64	53.17	39.34
52.662	2.43	1.3	0.89	5.05	36.54	54.69	40.81
39.462	2.4	1.17	1.3	8.22	33.43	55.9	50.09
37.162	2.27	1.11	1.25	9.81	33.07	58.2	54.98
33.262	2.19	0.92	1.64	10.56	33.02	60.59	59.33
32.862	2.19	0.92	1.97	11.09	33.58	62.83	62.64

Specimen: SDP-1.2-PLY-18 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.608	0	0.01	0.01	0.01	0	-0.01	-0.01
2.708	0.01	0.01	0.03	0.04	0.81	1.08	0.82
3.608	0.03	0.03	0.03	0.04	1.48	1.93	1.49
4.708	0.06	0.03	0.03	0.07	2.29	2.99	2.28
5.608	0.07	0.04	0.04	0.12	2.92	3.84	2.9
6.608	0.07	0.06	0.06	0.18	3.75	5.05	3.77
7.608	0.1	0.06	0.06	0.21	4.28	5.62	4.21
8.608	0.1	0.06	0.07	0.23	4.89	6.51	4.9
9.608	0.1	0.06	0.07	0.25	5.25	7.29	5.39
10.608	0.1	0.07	0.07	0.25	6.21	8.21	6.04
11.708	0.12	0.09	0.09	0.25	6.92	9.14	6.68
12.608	0.12	0.12	0.09	0.26	7.54	9.94	7.24
13.608	0.12	0.14	0.12	0.26	8.18	10.78	7.79
14.608	0.14	0.17	0.14	0.28	8.91	11.7	8.41
15.708	0.14	0.17	0.14	0.26	9.68	12.68	9.08
16.608	0.14	0.2	0.15	0.26	10.3	13.49	9.61
17.708	0.09	0.21	0.14	0.23	10.98	14.39	10.23
18.608	0.09	0.26	0.17	0.31	11.88	15.58	11.04
19.808	0.06	0.26	0.18	0.34	12.28	16.09	11.39
20.708	0.03	0.28	0.2	0.32	12.71	16.68	11.8
21.608	0.01	0.29	0.23	0.34	13.27	17.53	12.45
22.608	0	0.28	0.25	0.32	13.79	18.13	12.8
23.608	-0.03	0.29	0.26	0.34	14.38	18.99	13.46
24.708	-0.04	0.31	0.29	0.34	14.97	19.8	13.96
25.608	-0.04	0.34	0.32	0.34	15.6	20.69	14.58
26.708	-0.09	0.32	0.34	0.32	16.18	21.51	15.15
27.808	-0.1	0.36	0.36	0.36	16.87	22.48	15.83
28.508	-0.12	0.36	0.37	0.37	17.29	23.09	16.26
29.508	-0.14	0.37	0.36	0.39	17.87	23.94	16.85
30.608	-0.15	0.4	0.4	0.39	18.52	24.88	17.5
31.608	-0.15	0.45	0.43	0.42	19.09	25.71	18.08
32.608	-0.2	0.48	0.43	0.43	19.71	26.62	18.72
33.508	-0.18	0.53	0.47	0.47	20.31	27.49	19.33
34.708	-0.21	0.54	0.5	0.47	20.96	28.44	19.98
35.508	-0.21	0.59	0.51	0.53	21.59	29.35	20.61
36.508	-0.2	0.62	0.54	0.54	22.21	30.25	21.23
37.608	-0.2	0.67	0.59	0.54	22.88	31.22	21.91
38.908	-0.17	0.7	0.62	0.59	23.69	32.4	22.72
39.608	-0.17	0.73	0.65	0.64	24.27	33.23	23.3
40.508	-0.15	0.81	0.69	0.67	24.87	34.09	23.88
41.508	-0.12	0.83	0.72	0.75	25.59	35.12	24.57
42.608	-0.1	0.86	0.75	0.8	26.3	36.15	25.29
43.508	-0.07	0.91	0.76	0.81	26.93	37.04	25.89
44.508	-0.04	0.95	0.8	0.86	27.66	38.15	26.71
45.808	0.01	1	0.84	0.94	28.59	39.41	27.52
46.608	0.06	1.05	0.87	0.95	29.28	40.39	28.19
47.408	0.12	1.11	0.91	1	30.12	41.56	28.99
48.608	0.17	1.14	0.95	1.02	30.95	42.73	29.78
49.508	0.21	1.19	0.98	1.06	32.02	44.22	30.81
50.508	0.28	1.25	1.02	1.16	32.87	45.39	31.63
51.608	0.36	1.33	1.05	1.25	34.03	47	32.79
49.208	0.37	1.41	1.13	1.93	34.31	48.42	35.46
49.408	0.36	1.41	1.2	2.07	34.43	48.87	36.2
48.608	0.36	1.42	1.31	2.32	34.67	49.81	37.6
45.108	0.28	1.44	2.02	2.76	33.86	49.98	40.54

43.908	0.21	1.41	2.29	2.95	34.13	51.02	42.34
42.508	0.17	1.36	2.93	3.48	34.83	53.56	46.54
40.108	0.12	1.33	3.4	4.3	35.49	56.5	52.06
36.908	0.09	1.3	4.06	4.63	35.89	58.87	57.06

Specimen: PEVA-1.0-PLY-9.5 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.288	0.01	0	-0.01	0	0	-0.01	-0.01
2.288	-0.01	-0.03	0.03	0.01	1.83	2.36	1.66
3.388	-0.06	-0.07	0	0	3.42	4.45	3.16
4.388	-0.09	-0.1	0.01	0	4.97	6.51	4.59
5.288	-0.14	-0.14	0.03	0	6.54	8.57	6.03
6.388	-0.17	-0.18	0.01	0	8.26	10.89	7.63
7.288	-0.2	-0.21	0	0	9.91	13.35	9.34
8.388	-0.21	-0.25	0	0.01	11.16	14.96	10.46
9.188	-0.23	-0.25	0	0.01	12.26	16.54	11.57
10.588	-0.28	-0.21	-0.04	0.04	14.07	19.15	13.41
11.388	-0.29	-0.21	-0.07	0.04	15.3	20.9	14.68
12.388	-0.23	-0.2	-0.09	0.09	16.76	23.68	16.19
13.288	-0.18	-0.18	-0.12	0.12	18.18	24.99	17.65
14.388	-0.14	-0.18	-0.17	0.14	19.95	27.51	19.49
15.188	-0.51	-0.18	-0.18	0.15	21.29	29.24	20.89
16.288	-0.59	-0.2	-0.23	0.18	23.31	32.68	22.99
17.488	-0.53	-0.17	-0.29	0.23	26.2	36.4	26
18.088	-0.47	-0.17	-0.34	0.25	27.43	38.86	27.31
18.088	-0.4	-0.14	-0.37	0.51	27.85	40.93	30.75
15.288	-0.42	-0.03	-0.43	1	28.17	42.97	36.35
14.788	-0.34	0.26	-0.95	1.08	36.75	63.92	61.86

Specimen: PEVA-1.0-PLY-9.5 Test B

Sampel B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.288	0	0.03	0.03	0.03	-0.01	0	-0.02
2.588	0.03	0	0	0.06	1.99	2.82	2.16
4.288	0.03	-0.12	-0.07	0.1	4.62	6.46	4.9
5.288	0.07	-0.15	-0.12	0.14	6.23	8.61	6.48
6.288	0.1	-0.2	-0.15	0.17	7.79	10.68	7.98
7.188	0.14	-0.21	-0.18	0.18	9.11	12.44	9.23
8.288	0.17	-0.29	-0.23	0.21	10.84	14.72	10.85
9.288	0.18	-0.36	-0.26	0.23	12.2	16.58	12.2
10.188	0.18	-0.42	-0.31	0.25	13.39	18.21	13.39
11.288	0.18	-0.5	-0.39	0.32	15.27	20.75	15.27
12.288	0.17	-0.53	-0.43	0.32	16.62	22.59	16.63
13.288	0.21	-0.58	-0.47	0.34	18.12	24.62	18.12
14.288	0.26	-0.64	-0.54	0.39	19.95	27.3	20.14
15.188	0.36	-0.7	-0.62	0.43	21.35	28.97	21.36
16.288	0.45	-0.8	-0.7	0.5	23.3	31.68	23.34
17.188	0.53	-0.87	-0.81	0.54	24.92	33.97	24.99
18.288	0.67	-1.03	-0.95	0.64	27.5	37.65	27.65
19.188	0.8	-1.13	-1.05	0.72	29.72	40.75	29.78
19.088	1	-1.24	-1.11	0.75	31.97	43.71	31.11
16.088	1.8	-1.41	-1.08	0.91	36.05	46	30.61

16.288	2	-1.5	-1.08	0.97	39.12	48.65	31.46
14.988	2.27	-1.49	-1.03	0.95	42.03	50.46	31.87

Specimen: PEVA-1.0-PLY-12.7 Test A

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.366	0.01	0.01	0.01	0	-0.02	0.01	0.01
2.666	-0.01	-0.06	0.04	-0.01	2.33	2.68	1.84
3.966	-0.04	-0.23	0.03	-0.01	4.21	5.08	3.54
4.366	-0.04	-0.28	0.01	-0.01	4.9	6.13	4.33
5.366	-0.03	-0.4	0.03	0	6.22	7.67	5.32
6.566	-0.01	-0.54	0.03	0	8.13	10.24	7.21
7.466	0	-0.69	0.04	0	9.48	11.93	8.26
8.366	0.04	-0.84	0.07	-0.01	10.64	13.51	9.35
10.066	0.09	-1	0.09	-0.04	12.84	16.55	11.4
10.566	0.1	-1.03	0.12	-0.03	13.66	17.83	12.44
11.466	0.04	-1.11	0.12	-0.04	14.84	19.32	13.34
12.266	-0.03	-1.16	0.12	-0.06	16	21.01	14.64
13.466	-0.07	-1.17	0.14	-0.07	17.73	23.37	16.21
14.366	-0.09	-1.19	0.12	-0.09	19.27	25.5	17.7
15.466	-0.07	-1.19	0.14	-0.09	20.94	27.74	19.26
16.366	-0.09	-1.19	0.14	-0.12	22.53	29.86	20.72
17.666	-0.09	-1.13	0.09	-0.12	25.04	33.19	23.14
19.066	-0.06	-1.05	0.07	-0.12	27.59	36.24	25.07
18.866	-0.01	-0.98	0.07	-0.09	29.35	38.03	26.32
18.466	1.49	-0.07	0.03	-0.17	42.86	46.3	29.39
17.666	2.29	0.5	0	-0.23	47.12	48.89	30.32
16.566	2.41	0.62	0.01	-0.21	46.96	48.19	29.66

Specimen: PEVA-1.0-PLY-12.7 Test B

	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.366	0	0.01	0	0	0	-0.03	0.01
2.466	0.03	0.01	0.01	-0.06	1.25	1.84	1.35
3.766	-0.01	-0.06	-0.01	-0.17	2.86	4.03	2.98
4.366	0	-0.12	-0.01	-0.2	3.61	5.95	3.71
5.466	-0.01	-0.2	-0.04	-0.23	4.98	5.29	5.05
6.666	0	-0.26	-0.04	-0.26	6.49	8.87	6.48
7.466	0	-0.31	-0.04	-0.28	7.51	10.3	7.61
8.566	0	-0.36	-0.03	-0.26	8.9	12.12	9.03
9.466	0.01	-0.39	-0.01	-0.26	10.26	14.14	10.28
10.466	0.01	-0.42	-0.03	-0.28	11.65	15.86	11.49
11.466	0	-0.47	-0.04	-0.26	12.53	16.27	12.64
12.366	-0.01	-0.51	-0.01	-0.26	13.52	19.25	13.56
13.266	-0.01	-0.53	-0.01	-0.25	14.94	19.67	14.98
14.266	-0.04	-0.54	-0.03	-0.25	16.11	22.06	16.2
15.866	-0.07	-0.56	-0.07	-0.29	18.36	25.11	18.52
16.466	-0.03	-0.58	-0.07	-0.23	19.42	26.62	19.66
17.366	-0.04	-0.65	-0.1	-0.26	20.85	28.78	21.54
18.466	-0.03	-0.72	-0.14	-0.25	22.97	31.47	23.41
19.566	-0.03	-0.78	-0.2	-0.28	24.17	33.19	24.84
20.166	-0.03	-0.81	-0.23	-0.26	25.34	34.63	25.87
21.866	-0.03	-0.89	-0.34	-0.28	27.96	38.1	28.54
22.266	-0.01	-0.92	-0.4	-0.26	29.13	39.59	29.71

23.466	-0.01	-0.97	-0.5	-0.26	31.78	42.97	32.43
24.066	0.01	-0.98	-0.67	-0.29	34.58	47.54	38.47
21.166	0.03	-1.03	-0.73	-0.21	34.23	48.78	43.19
20.566	0.01	-1.02	-0.72	-0.17	35.37	51.47	47.61
19.466	0.04	-1.02	-0.65	0.07	35.88	53.97	52.75

Specimen: PEVA-1.0-PLY-18 Test A

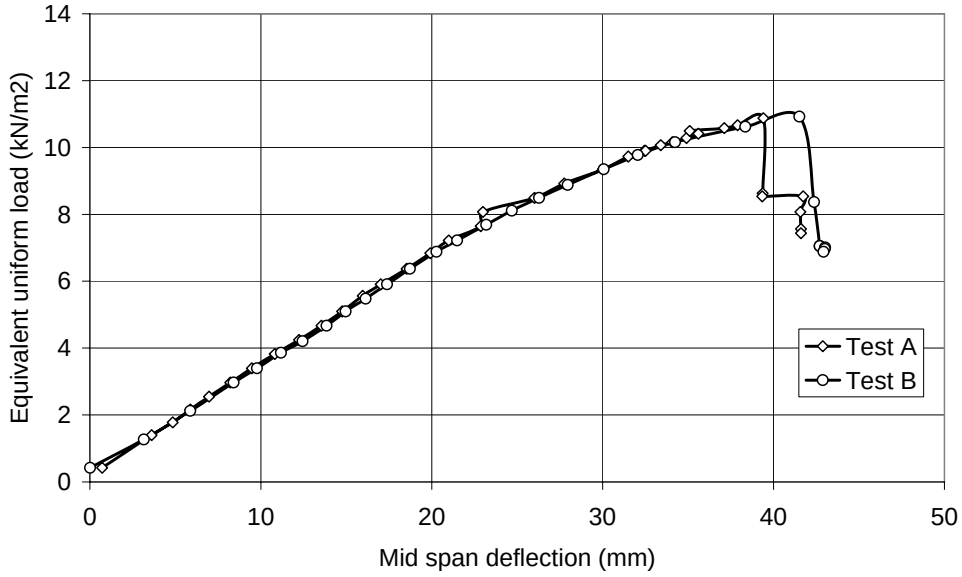
	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.445	0	0	0	0	0.01	0.01	0.01
2.545	0.01	-0.01	-0.01	0	1.33	1.66	1.27
3.645	0.04	-0.04	-0.01	-0.01	2.54	3.15	2.37
4.445	0.06	-0.04	-0.01	-0.03	3.67	4.57	3.41
5.345	0.09	-0.06	-0.01	-0.06	4.59	5.67	4.19
6.345	0.1	-0.07	-0.01	-0.09	5.74	7.14	5.24
7.545	0.14	-0.15	-0.03	-0.09	7.12	8.9	6.6
8.345	0.17	-0.21	-0.06	-0.07	8.11	10.14	7.58
9.445	0.18	-0.26	-0.04	-0.09	9.61	12.09	9
10.645	0.21	-0.32	-0.06	-0.17	10.82	13.66	10.2
11.545	0.23	-0.36	-0.06	-0.17	11.86	15.07	11.25
12.545	0.26	-0.42	-0.06	-0.17	12.91	16.46	12.31
13.545	0.29	-0.48	-0.07	-0.15	14.09	18.13	13.63
14.445	0.28	-0.56	-0.09	-0.17	15.1	19.44	14.59
15.445	0.28	-0.58	-0.09	-0.15	16.31	21.15	15.95
16.645	0.23	-0.61	-0.09	-0.15	17.75	23.03	17.37
17.645	0.21	-0.62	-0.1	-0.12	18.96	24.79	18.62
18.445	0.23	-0.64	-0.14	-0.12	20.37	26.66	20.11
19.345	0.25	-0.69	-0.17	-0.12	21.59	28.41	21.41
20.445	0.37	-0.69	-0.18	-0.12	23.16	30.51	23.09
21.445	0.45	-0.72	-0.25	-0.12	24.46	32.36	24.6
22.245	0.53	-0.76	-0.31	-0.12	26.05	34.46	26.12
23.545	0.62	-0.83	-0.4	-0.12	27.87	36.81	28.13
24.645	0.72	-0.83	-0.47	-0.1	29.43	39	29.74
25.445	0.78	-0.81	-0.51	-0.12	31.06	41.18	31.61
26.445	0.87	-0.8	-0.58	-0.12	32.89	43.64	33.75
27.545	0.95	-0.8	-0.62	-0.14	35.09	46.75	36.29
28.345	1.08	-0.75	-0.61	-0.15	37.52	49.45	38.43
24.745	1.71	-0.62	-0.62	-0.18	44.75	52.58	38.84
24.245	1.77	-0.67	-0.61	-0.2	47.19	53.73	38.96
24.645	1.85	-0.75	-0.61	-0.2	49.39	55.09	39.6
23.745	2.18	-1	-0.61	0.21	52.19	56.52	39.97
23.745	2.27	-0.97	-0.59	-0.23	55.51	59.1	40.97
20.145	3.45	-0.42	-0.58	-0.2	59.76	59.65	40.06

Specimen: PEVA-1.0-PLY-18 Test B

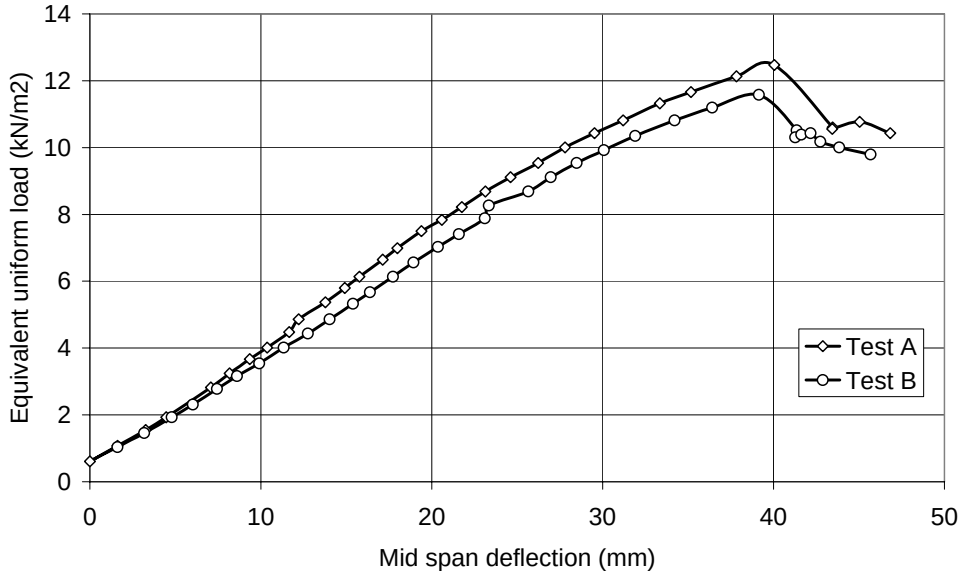
	Displacement (mm) (LVDT)						
Total load, P (kN)	1	2	3	4	5	6	7
1.138	-0.01	0	-0.01	-0.01	0	0.01	0
3.038	-0.14	-0.07	-0.04	-0.04	2.35	3.23	2.51
4.238	-0.18	-0.17	-0.03	-0.03	3.85	5.28	4.02
5.138	-0.2	-0.23	-0.01	-0.03	4.95	6.74	5.08
6.238	-0.17	-0.32	0.01	0	0.642	8.7	6.51
7.038	-0.17	-0.4	0.06	0.04	7.51	10.16	7.57
8.138	-0.17	-0.45	0.07	0.03	8.98	11.98	8.95
9.138	-0.15	-0.51	0.12	0.04	10.3	14.3	10.27
10.438	-0.14	-0.59	0.18	0.04	12.03	16.17	11.75
11.138	-0.14	-0.61	0.21	0.06	12.98	17.32	12.61
12.138	-0.12	-0.64	0.26	0.06	14.29	18.86	13.8
13.038	-0.14	-0.67	0.29	0.06	15.54	20.46	14.94
14.238	-0.12	-0.72	0.32	0.06	17.18	22.49	16.39
15.238	-0.12	-0.73	0.34	0.04	18.45	24.01	17.5
16.338	-0.12	-0.76	0.37	0.06	20.06	26.01	18.9
17.038	-0.17	-0.76	0.39	0.06	21.23	27.36	19.83
18.038	-0.21	-0.8	0.39	0.06	22.86	29.15	21.06
19.038	-0.31	-0.78	0.42	0.07	25.68	31.72	22.73
20.138	-0.37	-0.81	0.4	0.06	30.9	36.66	25.15
19.838	-0.48	-0.83	0.42	0.06	36.48	39.81	26.68
19.638	-0.5	-0.81	0.42	0.06	36.59	39.79	26.6
20.238	-0.5	-0.83	0.4	0.04	41.62	43.61	28.49
20.338	-0.48	-0.83	0.42	0.06	42.59	44.39	28.82
21.138	-0.54	-0.83	0.42	0.06	45.11	46.46	30.1
22.838	-0.56	-0.8	0.42	0.07	46.85	48.6	31.82
23.538	-0.61	-0.81	0.42	0.06	47.42	49.47	32.46
24.138	-0.64	-0.8	0.43	0.07	48.39	50.49	33.49
24.938	-0.67	-0.81	0.43	-0.01	49.36	51.86	34.81
25.938	-0.72	-0.8	0.45	-0.1	50.49	53.57	36.6
22.438	-0.73	-0.8	0.69	-0.15	50.73	54.72	40.15

APPENDIX II – Graphs of Equivalent loads versus Mid-span Deflections

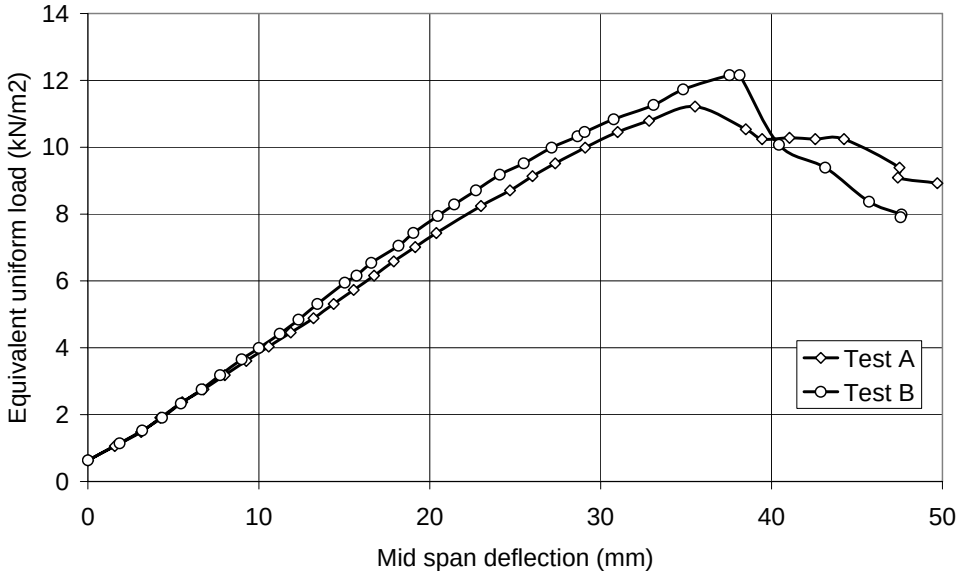
SDP-0.8-PLY-9.5



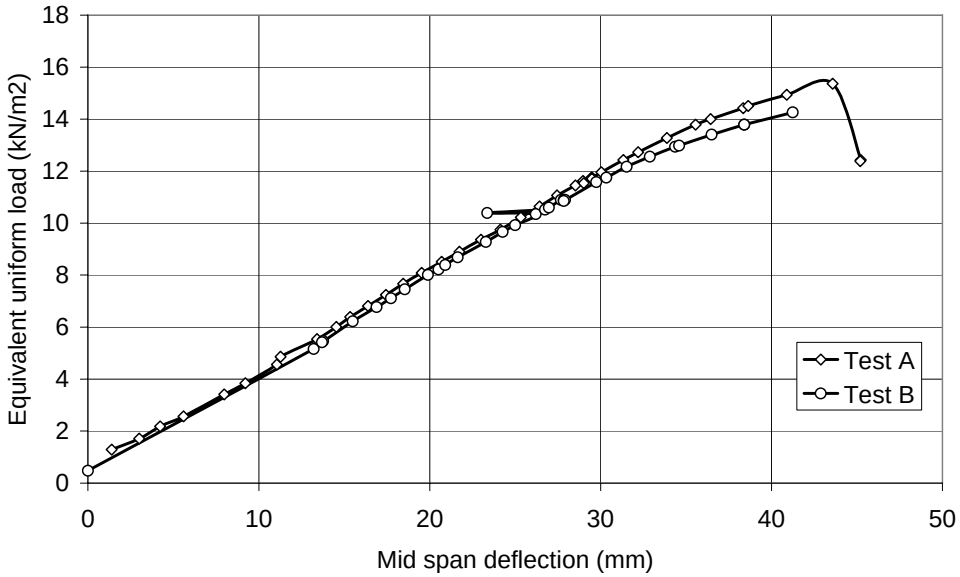
SDP-0.8-PLY-12.7



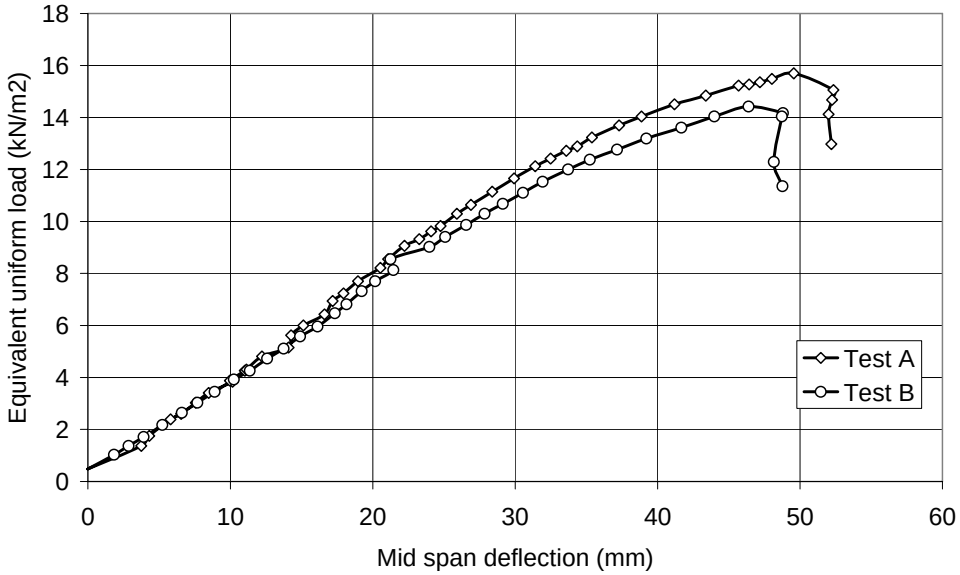
SDP-0.8-PLY-18



SDP-1.0-PLY-9.5



SDP-1.0-PLY-12.7



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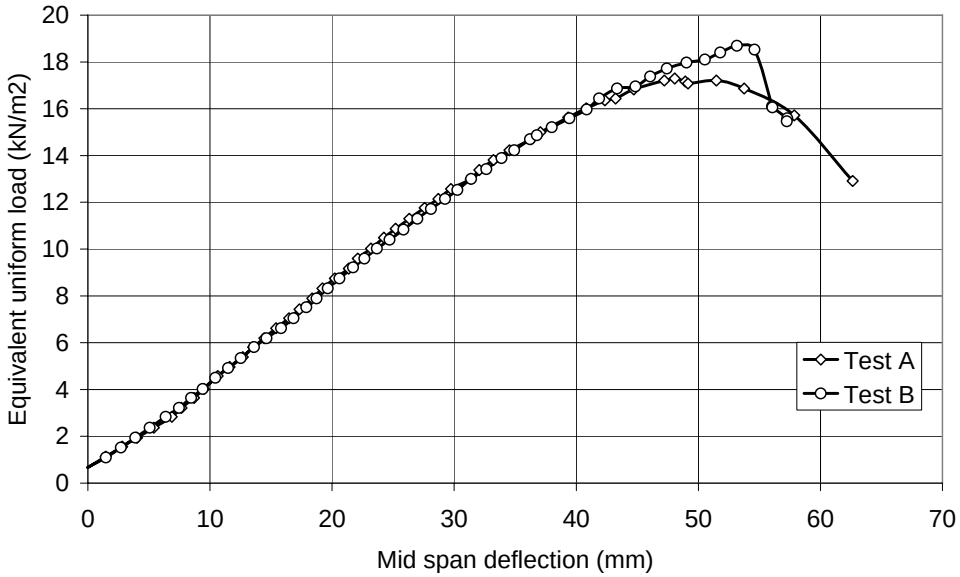

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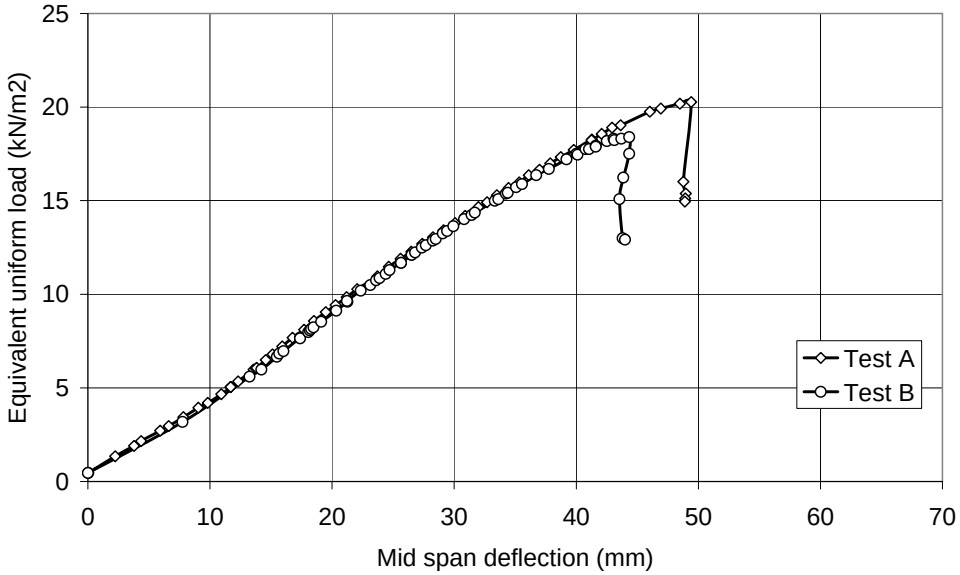

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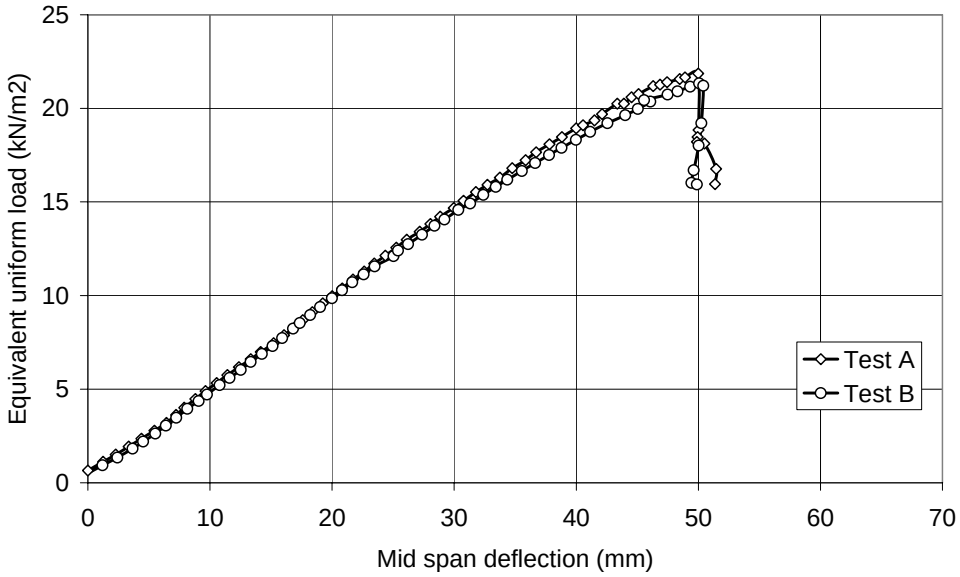

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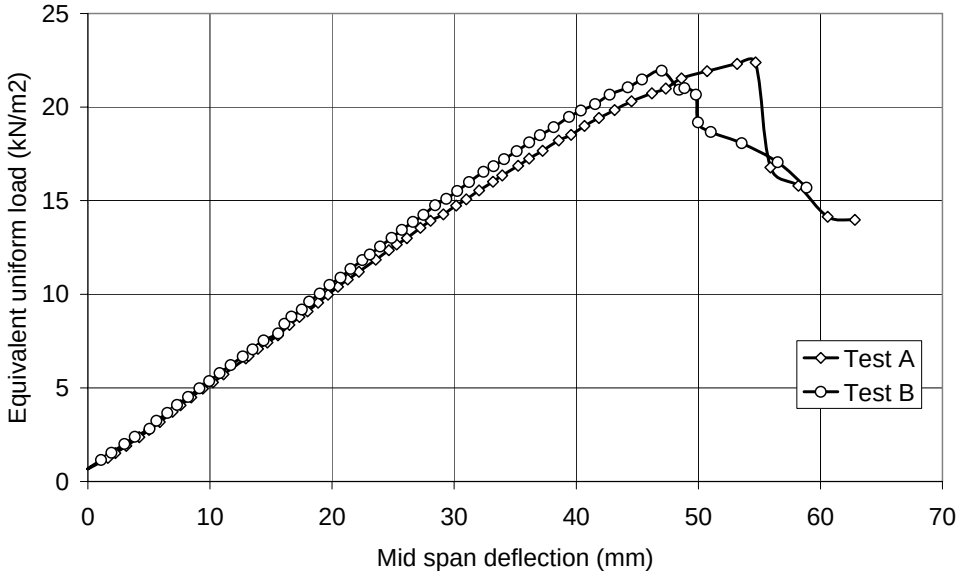
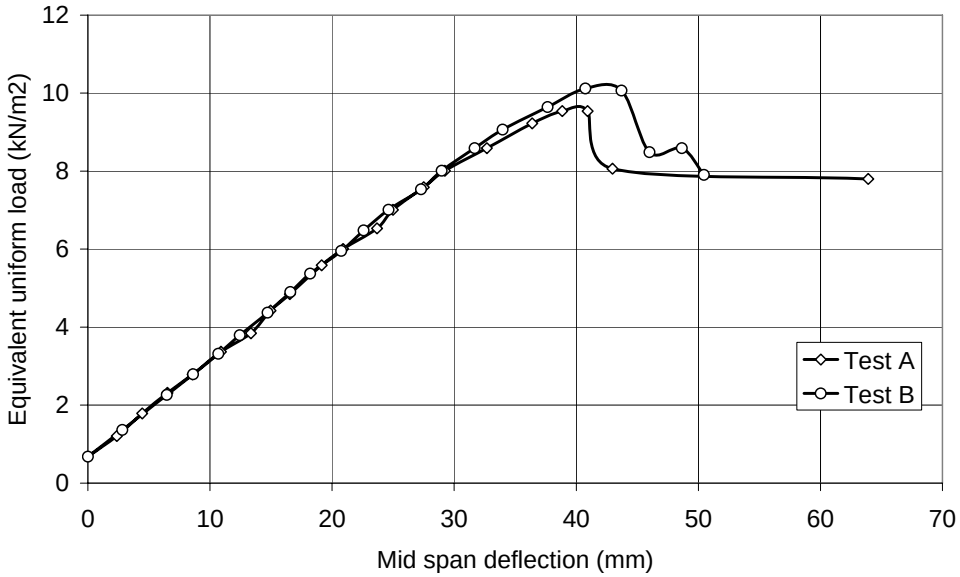
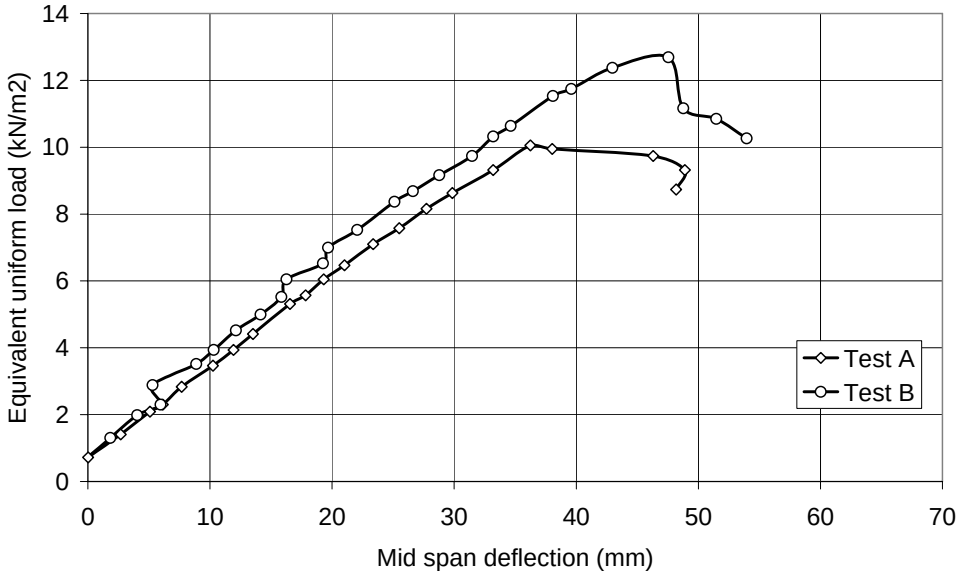


PEVA-1.0-PLY-9.5



PEVA-1.0-PLY-12.7



PEVA-1.0-PLY-18